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MR. JESSE HEALY MORLEY, Vice-President of the Cleveland (O.) Gas Light and Coke Company, died at his home in that city, the morning of the 21st inst. He was in his 84th year.

Eleventh Annual Meeting, Pacific Coast Gas Association.

PACIFIC COAST GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
SAN FRANCISCO, CAL., June 16, 1903.

The Eleventh Annual Meeting of the Pacific Coast Gas Association will be held in San Francisco, Cal., at the offices of the Pacific Gas Improvement Company, 455 Sutter street, Tuesday, Wednesday and Thursday, July 21st, 22d and 23d, 1903. The following papers will be read:

President's Address; by Mr. M. C. Osborn, San Francisco, Cal.

Wrought Pipe; by Mr. Franklin Riffle, San Francisco, Cal.

High Pressure Gas Distribution; by Mr. John A. Britton, Oakland, Cal.

Liquid Air: Its Application to the Gas Industry; by Prof. G. A. Bobrick, Los Angeles, Cal.

The Oil Industry of California from a Commercial Standpoint; by Dr. C. T. Deane, San Francisco, Cal.

Our Customers and Their Complaints; by Mr. D. Decker, Santa Rosa, Cal.

A Paper (subject to be announced later); by Mr. L. P. Lowe, San Francisco, Cal.

In addition to the above papers there will probably be contributions by at least two of the members on "Short Topics" of interest to the fraternity.

Arrangements have been made for a popular lecture on Liquid Air, by Prof. Bobrick, which will be given at the regular meeting place, Tuesday evening, July 21st, 1903. The lecture will be accompanied by experiments. It is the intention to make this lecture essentially a popular one, and members are cordially invited to bring their friends including ladies. Informality will be the order of the evening.

Wednesday evening, July 22d, will be the occasion of the annual banquet, to be held at Delmonico's, at which members only will be present.

On Thursday, July 23d, an all-day trolley car ride will be given and members will be conveyed by special cars to many points of scenic and historic interest in San Francisco and thereabout. An opportunity will also be afforded them to inspect at least one of the large power plants in the great Metropolis of the Pacific. Luncheon will be served at the Cliff House, and ample time will be allowed for a visit to Sutro baths (the largest in the world), or a stroll upon the beach. Following the usual custom, ladies will be welcome on the outing.

Through the courtesy of the Mechanics' Institute, arrangements have been made whereby the privileges of the Mechanics' Library, 33 Post street, are granted to all members of the Pacific Coast Gas Association during the period of its 11th annual meeting. Mr. J. M. Cummings, Secretary, acting for the Institute, extends to members a cordial invitation to make free use of the books and rooms of the Library, and will take pleasure in giving them any information or assisting them in any way in the use of the Library. It is hoped that members will show their appreciation by availing themselves of these privileges. No entrance tickets are required, but members will kindly wear the convention badge as a means of identification.

LIBRARY OF CONGRESS 45259 JUN 29 1903 SMITHSONIAN DEPOSIT.

Members are strongly urged to lend their individual support to

The Wrinkle Department: Mr. Geo. H. Colquhoun, Fresno, Cal., Editor.

The Experience Department: Mr. R. P. Valentine, Sacramento, Cal., Editor.

The Novelty Department: Mr. Geo. H. Hollidge, Merced, Cal., Committee in charge.

The Wrinkle and Experience Departments depend for their very existence upon the willingness of members to contribute, and are an index of the "lag" or "lead" of the Association as a whole. Please remember this and help to maintain the standard.

The Novelty Department is, in truth, a novelty this year. In it we hope to find samples or models of all the good things manufactured during the past year for which a "gas man" has use. If you know of any, communicate immediately with Mr. Hollidge.

The Question Box.—An effort is being made this year to give the Question Box the attention which it merits, and to this end a special communication has been issued on the subject. An immediate reply thereto is requested.

The Secretary will be glad to meet members and furnish information, at any time prior to the meeting, at 628 Rialto Building, San Francisco, Cal.

J. B. GRIMWOOD, Secretary.

BRIEFLY TOLD.

ANNUAL MEETING, AMERICAN WATER WORKS ASSOCIATION.—SPECIAL EDITORIAL CORRESPONDENCE.—"DETROIT, MICH., June 23d. Dear JOURNAL: The 23rd annual convention of the American Water Works Association was called to order at 10 A.M., in the breakfast room of the Cadillac Hotel, by the President. Mr. Chas. H. Campbell, who is Superintendent of the municipally owned water works at Charlotte, N. C. A large gathering of the members responded to roll call, and the delegates were welcomed in an interesting address by the Hon. Wm. C. Maybury, Mayor of Detroit. The thanks of the Association for the kind words of the Mayor were fittingly tendered by Mr. L. N. Case, of Duluth, Minn., the First Vice-President of the Association. Upward of 70 new members were added to the rolls, and the report of Secretary and Treasurer J. M. Diven, of Elmira, N. Y., was very gratifying to the Association. The President's address was replete with practical suggestions as to the manner of increasing the usefulness of the Association. Many of these would prove of value if put in practice by our Associations of Gas Engineers. Particularly is this true about his remarks upon the importance to the Association of its associate members and the technical press, and of the duty of the active members to uphold and encourage these important adjuncts to the life of the Association. The papers on "Electrolytic Action on Underground Pipes," and the "Life of Cast Iron Pipes," together with the discussions thereon, promise to be of considerable interest and value to the gas fraternity. Joint action by the Gas and Water Associations toward compiling facts and proofs would result in important data for use in the courts to protect the property of the two classes of works.—A. E. B."

NOTES——

THE Western Gas Construction Company has been awarded a contract for the construction of a 7 foot 6 inch set of its latest improved design of water gas apparatus on the plant of the Binghamton (N. Y.) gas works. This order is to be shipped complete from the Construction Company's shops within 30 days from date of contract.

THE proprietors of the Lawrence (Mass.) Gas Company have purchased the stock of the Andover Electric Company, and hereafter the plant will be operated by the first named corporation.

THE Tuckerton (N. J.) Gas Company, to construct and operate a gas works in the named place, has been incorporated by Messrs. F. R. Austin, J. H. Webb, C. H. Conover and others. It is capitalized in $20,000.

THE Bristol Company, of Waterbury, Conn., has forwarded us copies of its revised editions of catalogues of its well-known recording pressure and vacuum gauges and recording volt, ampere and watt meters. These catalogues contain complete lists of recorders recently added to the Company's large lines of instruments of this sort. Copies will be forwarded on application to the home office at Waterbury.

THE new plant of the Citizens Gas, Electric and Heating Company, of Mount Vernon, Ills,, is completed, and gas will be supplied regularly on the 1st prox.

[OFFICIAL REPORT.—REVISED BY THE SECRETARY.—Continued from Page 970.]

TWENTY-SIXTH ANNUAL MEETING, WESTERN GAS ASSOCIATION.

HELD AT INDIANAPOLIS, IND., IN THE CLAYPOOL HOTEL, MAY 20, 21 AND 22, 1903.

SECOND DAY—MORNING SESSION.

NAPHTHALINE.—NO. II.

[By DR. W. H. BIRCHMORE, Brooklyn, N. Y. For the first part of the Birchmore paper, see JOURNAL, June 22, p. 962.]

We may be content with this knowledge of the relations of the groups and say that ordinary coal gas, as made by the processes in vogue before higher temperatures were made needful by the demand for greater yields and brighter flames, corresponded with the analysis by Bunsen; that his assertions in regard to the typical contents of any given illuminating gas were quite correct, however much the present methods and analysis may differ from his methods and results, and that his conclusion that benzol was the highest of the hydrocarbon molecules which had to be considered was true at that day; but he would not be justified in saying it to-day, and we as certainly know that we are not justified in so doing, even if we substitute the word "illuminants" in our reports to cover up our concealment, that we have not determined either the identity or the percentages of the members of this uncertain group, especially if examining a gas, in which the naphthaline having remained in the tar but partially, benzol and "the illuminants" are no longer interchangeable terms.

At this state of the inquiry it may be well to consider for a few moments the facts in relation to the solution of the naphthaline by the tar. While it is now generally believed that the true solvent is the anthracene oil, quite a respectable minority seem inclined to say that the isomeric oil, phenanthracene, or phenanthrene, is the real dissolving agent, since these are both present in all tars, but in various proportions; others affirm that the solution of anthracene in phenanthrene is the one essential condition. It is not worth while to enter into a discussion of this particular point, important as it is, until some one has been able to experiment exhaustively on both with a plant so built that they may be used either together or apart and their relations fully noted. It is enough for the present to say that both anthracene and phenanthrene are present in the tar which dissolves and holds the naphthaline.

It is also coming to be held as a pious opinion by not a few, and by the men most familiar with the chemistry of the question, that the cause of the naphthaline nuisance is to be found in the fact that the products of distillation remain for a long time, relatively a very long time, in contact with the retort walls, and that the walls and the most part of the charge are so hot that the "heavy oil," which used to dissolve the gas-contained naphthaline, is broken up. That by this "cracking process" valuable illuminants are formed is denied by none; but at the same time naphthaline is also formed, and that the amount of the naphthaline left by the combination and manufacture is beyond the measure which the small amount of the oil which escapes the cracking process can take up seems to be a manifest fact. From these premises they draw the conclusion that the naphthaline nuisance is a direct product of the scheme of temperature management now in vogue. Of course, this is denied by the partisans of the high (very high) temperature theory, among which are a few who deny the very fact of the solvent action of the oils, while others deny their destruction by the excessive temperatures.

These questions are obviously vital to the matter in hand, nor do I see how they can be worked out until some rational way is found for regulating temperatures. An admirable little appliance for ascertaining the temperature within certain limits was invented some few years ago in Philadelphia, but it certainly is not in common use. In fact every man is isolated from his fellows' experience by the fact that if A does not know how hot his retort was when a certain phenomenon happened, how then shall he try to make his experience useful to B?

To one used to working with apparatus by which the heat of a furnace can be recorded, no matter how conventional the scale, the condition of the gas works' manager seems like that of a seaman navigating without a compass. It is not of any use to attempt to narrate my experiments on this part of the subject, although it is the most important part, in any fullness simply because there is no means at my command of bringing before you relatively small differences in the temperature of the retorts. Thinking that I might get some clever suggestion,

as I have time and again from a question box, I asked this from one of the State Associations, and got two peculiar answers, two questions having been asked. To my question, how hot the retorts were to be, I received as reply, "1,890°, or a bright cherry red, was considered the limit of temperature," but the information of the scale on which the 1,800° was reckoned was not given, nor any clear intimation as to the light, for no two men see color alike, nor do colors seem the same to the same man twice. To my other question I received the answer, "No one was using a pyrometer." Under these conditions it is useless to give details and I simply state my conclusions. My attempt seems to have brought out one fact—the consensus as to the cause of naphthaline formation—which was said to be "too high temperature in the retorts," and "too light charge."

My own experiments incline me to the conclusion that the naphthaline problem looks like one of those signs which change their reading with a change in the point of view, and that amidst the conflict of evidence there is a statement of fact, overclouded by large fancy, however.

If the true gases and the whole of the vapors obtainable from the coal are carried through the secondary furnace, which I have described, and for convenience shall call "the superheater," a long iron tube filled with small pieces of coke and heated very hot indeed by a specially constructed gas furnace, great changes are produced in the gas. The oils are more or less detroyed, the absolute amount of destruction being uncertain. The amount of "pitch" is relatively much increased, the naphthaline content is augmented largely, and apparently the amount of the increase in the naphthaline had a definite relation to the amount of oil destroyed.

It was also apparent that the decompositions followed the lines which have been repeatedly suggested by writers of scientific papers on the structural composition and decomposition of hydrocarbon gas and vapors.

Thus the benzol content is seemingly increased from one-half to two-thirds, but in cases in which the decomposition seems to have influenced the anthracene rather than the phenanthrene, and there are such, acetylene molecules are distinguished; but in the more usual experience the miscellaneous free molecules unite to form more stable unions after the pattern of the benzol ring rather than after the shape of the paraffine changes.

That is to say that the "acetylene bond" between the two benzol rings in the anthracene and phenanthrene has broken away, that three of these acetylene molecules have united forming benzol, which is at first very much increased. The two benzol rings thus freed at times seem to take up hydrogen completing their form, sometimes uniting with other substances developing side chains and in a multitude of ways making the unexpected substances which are all the time turning up in small quantities in the gas, but, if the action is sufficiently prolonged and the temperature sufficiently high, always ending in the formation of naphthaline. This naphthaline, of course, like everything else, comes from the superheater in the state of vapor, but it is no longer in the grasp of the anthracene oil. Even that portion of the oil which remains has for the time being lost its grip, and as the vapors are cooled the precipitated naphthaline comes down anywhere and everywhere, but chiefly where it is not wanted. Just as in practical working in the retorts of the gas house, so also here, a portion of the naphthaline seems to have come into the control of the mass of benzol molecules, to have been dissolved in, and to remain in solution in, the benzol vapor, as it were in permanent mechanical union with it, so to remain unless frozen out later on, or to be washed out with special apparatus.

Just so it is in the apparatus of the gas works and the street mains. In these, even in midwinter, some of the naphthaline remains in the grip of the benzol and the light oils and only comes down under conditions which make the precipitation which I have mentioned as occurring in my experiments simply inevitable, and then the vicious circle is complete, the nuisance is fully established, every condition for producing it is called into being, and to crown the work, all these vicious conditions are made self-perpetuating.

To remedy the naphthaline nuisance it was needed, first, to show the cause. This I have endeavored to do, so far as laboratory experiments could go, and I am sure that everyone of you as I have been speaking has been calling to his mind and memory facts from his own experience, which facts now make him willing to accept the offered proof of the thesis, which I propose as logical and as final. Having set before you the cause of the naphthaline nuisance, the opportunity is now given to me to suggest to you something of the remedy.

Permit me, first of all, to point out to you that two phases of the naphthaline problem exist. In one the amount of the absorbent oils is sufficient for taking up the naphthaline, but owing to various circumstances the oil cannot act. In the second case the absolute amount of oil is wanting, even if ample opportunity for action were permitted to it. This distinction is vital, and on it I was forced to found two distinct lines of experimentation. I am able to say that I have worked out the mechanics, both material and dynamic, of both of them and have constructed laboratory apparatus answering to both which under laboratory conditions did perfect work.

I shall lay before you all the facts and so much of the theory as seems needful for a full understanding of the solution of the question, and having done so shall leave the matter for treatment in stone and iron to the practical men.

When the oils and gas come from the retort both alike are vapor, but the oils quickly condense owing to their high boiling point, and are parted at once from the gaseous fraction by this simple fact. Custom dictated that they should be separated from the gas as soon as possible lest they should take up the benzol. As often happens, custom has survived under other conditions than those which justified its foundation. This parting of the oils and gas is as it should be. The oils, all of them and the whole of them (if so be there is enough for the task they have to do, then the works and their manager are indeed fortunate) should be taken out of the gas at the earliest possible moment; but they should be returned to it again in a specially designed way, in a specially designed scrubber to take out the naphthaline.

My experiments seem to show that the oil should be passed into an apparatus designed to expose the largest possible surface of the oil to the gas containing the naphthaline. When it enters this washer it should be at a temperature somewhat above the point at which naphthaline becomes solid and begins to fall from the gas. As the oil flows down through the scrubber it is gradually saturated with the naphthaline vapor; consequently, when it enters the apparatus, the oil which is naphthaline free meets a gas which contains but very little naphthaline, and both are at a temperature which leads the oil at once to dissolve any naphthaline it meets, absorbing naphthaline as it flows and, at the same time, rising in temperature, the power of absorption is decreasing, but much less rapidly than the lessening of the absorbability of the naphthaline, so that the rate of absorption runs rapidly to a minimum. Please to note that the direction of the flow of the oil is from *B* towards *A*, while at the same time the gas is flowing in contrary direction, from *A* towards *B*. The gas is constantly growing cooler and the oil warmer, and when the oil has reached a certain temperature the pump removes it nearly saturated with naphthaline to a suitable well for storage. Some one will object and say: "How about the benzol; is not that absorbed by the oil?" Of course it is; but since the oil can absorb only just so much, it can only take up a certain percentage; and since the oil lets go the benzol rapidly as it rises in temperature, the oil will have given up all the benzol which it has absorbed by the time it is pumped into the well. The effect is to keep the gas nearly saturated with benzol between the point at which the oil leaves the gas in the scrubber and the point at which the oil enters, although the amount taken up by the oil is not great, because naphthaline becomes solid at 80° C. and a vapor at 218° C.; between these two it is absorbable as a fluid. The oils which will be used will have a temperature of about the same height as the boiling point of the naphthaline, just a little less so that they may be said to be of the same temperature, and the oil saturates rapidly. At these temperatures benzol is a vapor under tension, a gas; and to fear disaster to our plans by reason of the absorption in any quantity of benzol is to be afraid of our own imaginations. In some of my experiments I did have trouble of this sort, because I used an oil with too low a boiling point, cooling the naphthaline more than was either needful or wise. For this reason I do not think so well of this plan as of another which I shall describe in a few moments.

The steps of this plan—Plan A, if you please may be put in order as follows: Step 1. Withdraw the oils from the gases at once. Step 2. Cool the oils to about 215° C. and pass them back into contact with the gas in a scrubber, as Step 3. The result will be the almost complete removal of the naphthaline. Some minor details must be attended to, but such are the bold outlines. The final disposal of the oil must rest with the needs of each case.

It chances that a very like plan was devised by an English engineer, and described in the *Journal of Gas Lighting* in an account of a meeting of a Society of Engineers. The number of the *Journal* is that for November 11, 1902, and the joint authors of the paper are Messrs. Thos. Glover and Wm. Young.

In abstract the paper was much as follows; but while this paper gives an illustration of the development of a phase of the general scheme which I have just sketched and is quoted as such, its chemistry is its

own. Words are used with a certain inaccuracy which might easily cause the reader to be misled concerning matters of fact; as, for example, concerning the origin of naphthaline in gas, and there are not a few statements whose logically necessary consequences must either have been unknown to, or ignored by, the writers—one cannot imagine the former of the propositions of this dilemma.

It seems an obligation to remind you that I am quoting this statement of their theory to explain their practice, not because it meets my conception of the facts. Had their study of the theory of naphthaline formation, their chemistry, if you will to call it so, been as competent as their perception of the trouble, considered simply as a mechanical difficulty from which they wished to escape, their contribution to the literature of the subject would have been as important as is their contribution to the practice of gas purification. And this practical application of the notion of washing out the naphthaline at a definite place would in its turn have lost nothing of its value; indeed it might have gained in importance.

In the number of the JOURNAL referred to the paper is given in full, and also the discussion which followed, and I advise its reading by every gas works' manager. My quotation is verbally accurate, but in a few places I have compressed some sentences and have transposed others to emphasize their premises and deductions. The paper reads: "The altered conditions account for the increased troubles from the presence of naphthaline, the naphthaline being produced in larger quantities and there being a diminished production of the solvent tars to take it up into solution. And, further, the hydrocarbon vapors with a higher tension than naphthaline being smaller, the increased volume of gas is less saturated by them, and the gas is in consequence capable of taking up, and retaining in diffusion during the process of condensation, an increased quantity of naphthaline. Or, to state it another way, the larger volume of gas and the proportionately smaller volume of the volatile vapors (these being mainly the vapors of benzol) and the smaller production of the solvent tars, places, so-to-speak, a wider gap between the saturation point of the gas and the tars. That is to say, that if the gas were brought into contact with a tar containing a large percentage of hydrocarbon vapors such as benzol, the unsaturated gas would take up in (by) diffusion a portion of such benzol vapors; and on the other hand if the tar were brought into intimate contact with gas more highly charged with benzol vapors the tar would dissolve out of the gas a part of such vapors." It is very difficult to determine how much of these sentences is to be looked upon as hypothesis and how much as demonstrated fact, but the following, which in the paper precedes that just quoted, is less ambiguous—has the form of an observation, but it is not stated to be so. The sentence reads, "With high temperatures a considerable proportion of the vapors, which under lower temperatures would ultimately condense as tar, are cracked up, mainly into permanent gases as carbonic oxide, hydrogen or (and) marsh gas, and into the stable hydrocarbons as naphthaline and benzol. The permanent gases are, therefore, much larger in volume and are capable of taking up and holding in diffusion a large volume of vapor. The denser tars are smaller in quantity and, therefore, less able to dissolve out of the gas the vapors of the hydrocarbons diffused through it. Not only so, but the natures of the hydrocarbon vapors predominating in the gas have been changed in character; being converted into naphthaline and the very volatile benzol, those of medium vapor tension being present in comparatively trifling quantities."

I confess my inability to understand these two series of statements, for it seems to me that hypothesis, observation and deduction are so intermingled that I am not able to rightly assort them, but if they represent observations, or logical deductions from observation, then I do not see how there can be any naphthaline problem, for it is only by closest study after the naphthaline problem has been practically eliminated, has been eliminated in practice, that such a theory of the action of the contained elements could be studied in detail. Yet my stricture which is not criticism, may be unfounded because the authors are dealing with a special coal, which may contain an assay of hydrocarbons as dissimilar to those of American coals of the same generic type, as are the cannel-like lignites and the "Coals of the Henry mountain region" to those of the Provo Valley or Cedar City levels in Utah. All are gas coals, and by some men are classed together under the name of "bituminous lignites," but they differ among themselves as much as Baku petroleum, the shale oil of the British Islands and Pennsylvania "coal oil." It suffices that the deductions or observations, be they which they may, do not apply to any coals which I have been able to examine. But however much one may question, and wish to study and discuss the chemical theories of the Glover-Young paper, there is no call for questioning the success of the Glover-Young process. The statements in chemistry may be confused in theory, the engineering practice shines as the sun.

The paper contains a resume of the process as follows:

"The process consists in collecting the denser tars from the gases while they are still warm, and holding in diffusion a considerable proportion of the high tension carbon vapors capable of being removed from the gas by condensation and solution. This is accomplished by collecting the tars deposited in the foul main while still hot, and fixing in any convenient position upon the foul gas main a tar extractor or separator, by which the liquefied particles suspended in the gas may be precipitated and collected. The tars are passed to a cooling and settling tank, whence (having parted with the ammoniacal liquor), the cooled tar is passed into a combined condensing and washing arrangement of any convenient form, by which the tars can be brought into intimate contact with the gas, the hot gas and the cooled tar being made to flow in opposite directions. The cooled tars having been removed from the gas while warm are comparatively free from naphthaline and possess practically the full solvent power. Also, being thus applied fractionally by being passed in among the cooled gas, and flowing back against the advancing current—they will, for well understood reasons, exercise the maximum cooling and washing effect, besides carrying away the naphthaline *as it is deposited.* [Please note this, "As it is deposited;" they do not say as fluid or as solid.] The tar being gradually heated, as it flows back against the current of warm gas, gives up the more volatile of the hydrocarbons, which they have absorbed in the cold end of the condenser washer, while the temperature is not sufficiently high to cause the revolatilization of the absorbed naphthaline. The tars would thus not only be employed to exercise their maximum solvent power for the naphthaline, but they would in turn be subjected to a distilling process to recover and retain in the gas the more volatile vapors."

Such is the description of the theory and practice of this process and its application, as set forth by its inventors after full opportunities for study of its practical application. To fully understand the process of reasoning by which the theory arrived at its present development requires a careful study of the paper, and the making of experiments with the identical sort of coal which they used. In the paper are given certain figures which might be of interest here. I am unable to compare them with corresponding American figures as such data were unobtainable from those to whose interest in the matter I appealed for information, and, therefore, I omit them since to give them alone would, I am sure, cause still more confusion rather than advance our enlightenment.

The second phase of this theory of removal requires a place of election for using the process and a choice in an absorbent for the naphthaline. There are a number of forms, phases is perhaps a better word, of this practice before the gas world. Some are simply "propositions," perhaps the majority have not passed beyond this stage, a few have run the gauntlet of the patent office, some very successfully, but it is a trial in which from what I hear I judge the larger part has come to grief. A few (they can be counted off on the fingers) have been translated into stone and iron. How successfully they are working I dare not attempt to say, judging by a prospectus or two which I have seen. Someone thinks that all promise well, a few promise better, and perhaps three really work.

Taken as a group the really effective machines seem to justify some such proposition as this, viz.: Owing to the uncertainty in amount and composition of the residual oils, it is a matter of economy to disregard any naphthaline absorption power which may be inherent in them—these residual oils that is, and to introduce at a point of election a supply of specially selected oil, of oil chosen for its value as a naphthaline absorbent and for this only, and to make use of this especially selected oil thus introduced instead of in any way or to any degree trusting to the thus abandoned residual oil.

How completely antithetical are the English scheme, that of Messrs. Glover and Young, as represented by their description in the quoted paper, and that of the German patents as given above, if I have correctly summarized the group, goes without saying. The fact that the proper agent for absorption is the heavy oil with a high boiling point commonly known as "anthracene oil," and sometimes spoken of or written of as "green oil," seems to be generally admitted; but how best to apply this oil seems as yet undetermined. How best to use it seems to be the end of all effort for most of the processes which I have studied, and it seems to me evident that not a single one of the inventors of these various processes had any precise working theory before his mind. The existence of a working theory of some sort seems almost a necessity, yet if it really exists the machines are so constructed that it is not apparent,

When chemists are constructing a plan from which to design some machine, for accomplishing some desired object, they first determine the scheme of the chemical reactions, then raise the question of what is called the temperature scheme, and it is certain that every detail of the plan will be worked out before it it is made even discussible as a design on paper for constructing engineers to consider; much will it be then discussed before it is made tangible, before it is translated into bricks and mortar, into brass and iron. This question of the new gas making is distinctly a chemical process, or rather a chemical industry of many independent processes, among which the process of getting the naphthaline nuisance under perfect control is by no means the least important; and in this process of naphthaline control one of the most important; yes, the most important item of them all, is the scheme of the working temperatures, the system of the temperature gradients to use the technical vocabulary. These important temperatures form an ascent in a regular order, beginning with the boiling point of benzene thus, the pressure being constant:

Benzene, freezing point			boiling point	(79° C.)
Naphthaline	"	[80° C.]	"	(218° C.)
Anthracene	"	[213° C.]	"	(351° C)
Phenanthrene	"	[103° C.]	"	(340° C.)

Bringing the gas under control, so that we secure the condensation and complete separation of these two last mentioned as the first step, we part them from the naphthaline and benzene while these are under such high tension, due wholly to temperature, that they react exactly as if they were true gases, and by this complete and rapid separation we prevent the formation of relatively confused mixtures and solutions of the vapors of these "heavy oils."

It should never be forgotten that the figures above given are for the pure or nearly pure substances, and they must be modified in order to adapt the oils to the duty we need them for. For the moment we simply wish to remove them with anything else condensible, which we do by rapidly cooling the vapors to 300° C., as nearly as may be. In the laboratory this is done by filling the condenser with the pure phenanthrene oil, which can, of course, not be heated hotter than its own boiling point, and in fact is usually some degrees cooler.

Please to note, then, that this first condensation removes the "heavy oils," so-called, in a nearly pure state, ready for any use we may see fit to make of them hereafter. Objections have been made to this process by a number of men—curiously enough the men were of the class commonly called "practical"—but the objections were and are wholly of the kind called "academic," or, to use the nomenclature of the practical men, the objections were, to the very last one, "theoretical objections."

My reason for advocating the removal of these components at the earliest possible minute, and their complete removal, agrees with the German rather than the English theory; but, when removed thus early, they leave behind them a mixture which it is possible to consider constant; and if allowed to remain in contact until cooled to a lower degree, say to 250° C., this constant or practically constant composition, a most important and most valuable characteristic, is quite lost. I have made experiments in both ways of treating the gas and all my results favor complete and early removal. The gas having been passed downward through this condenser to collect the heavy oils is now passed through a horizontal condenser to "freeze out the naphthaline."

That is to say, the vapor of the naphthaline, benzene and other condensible hydrocarbons is rapidly cooled to near 200° C. At this point we have a "naphthaline fog." The glass tube of the condenser is obviously wet with the fluid naphthaline and a beam of light shows that the tube is filled with naphthaline, condensed as a fog is, but not falling as rain nor frozen. The practical question is, shall we rapidly remove this by a centrifugal condenser, or shall we do so by cooling the gas to the freezing point of naphthaline; *i. e.*, to 80° C.

Bear in mind this important fact, at 80° C. naphthaline is solid and benzene is a gas, but in the presence of a mutual solvent, such as ethylene for instance, and specially if acetylene is present in no matter how small a quantity—as little as one part in 100 of the naphthaline has in more instances than one proved sufficient in my experiments—an amount of the naphthaline amounting to many per cent. will remain which cannot be frozen out. But while the benzene will dissolve, and thus prevent the solidification of a portion of the naphthaline, the solidified naphthaline will not occlude the benzene. At least I have never been able to effect such occlusion, nor do I find the record of such occlusion as made certain by the experiments of any other chemist.

Therefore, in this scheme of purification, the next step is to cool the gases and vapors, not to 218° C. but to about 70° C. By so doing all the naphthaline not held in solution by the benzol and ethylene is literally frozen out. It may be objected that the amount of naphthaline which can be made solid by cooling to 50° C. or 40° C., or even to 30° C., is so much greater that such solidification may take place some time in the future. This I am inclined to question for two reasons: First, because consecutive cooling of the gas, when it had been treated as suggested previously to the cooling, failed to bring down any deposit of naphthaline; secondly, because the solvent power of the benzol ethylene solution for naphthaline seemed rather to increase than to diminish with declining temperatures to 30° C. I made no experiments at temperatures below this one 30° C. for lack of time, but at this temperature the solvent power of the benzene-ethylene mixture seemed to be greater than an 80° C.

Assuming that one wished to remove the last vestiges of naphthaline and leave the gas so to say naphthaline free, it can be done by washing with the common "anthracene oil" of commerce which has been prepared for the purpose; or if the supply of heavy oils which have been saved is sufficient, they may be used.

These oils must be prepared for the purpose by getting into solution in them a certain percentage of benzol. Not as has been represented, to saturate them with benzol and thus prevent them from taking up any more, but in order that they may have a sufficient fluidity at the temperature at which we wish to use them.

Having obtained by judicious mixture an oil which has a fluidity at 70° C. to flow over and adhere to the surfaces which we may elect to use for constructing the absorbent apparatus, we permit it thus to flow, preferably from above downward, and cause it to come in contact with the gas containing the residual naphthaline. This the oil will remove, leaving the gas quite naphthaline free, but removing in the process nearly the whole of the benzene content. The gas thus treated requires enrichment; the benzol thus removed should be replaced for the sake of luminosity, and this can be done later after the gas has gone through such processes as are needed for its technical purification.

I would not have you misjudge me so far as to think that I fail to appreciate how much must be done, and in how many directions improvements must be made before any such simple means as this which I have sketched can be made practically useful. I appreciate them—yes, appreciate them fully; but the changes required are not great changes in bricks and mortar, they are not changes in the physical structure of the works to any great extent. One engineer with whom I discussed them said that the changes I proposed in plan and structure all tended towards simplicity and unity rather than towards complicating the present plans, but he raised an objection which he seemed to think insurmountable, "You will find that you cannot get *the men* you need to put in operation a system depending for its success on a careful attention to trifling details." He continued his criticism thus: "While the men have intelligence enough I doubt their good faith. When you are watching them it will be all right, but when your back is turned the inevitable disposition (they all think it) to get the better of or beat the boss, will make confusion in a system so nicely adjusted as this which you propose must be."

I am loath indeed to think that a system of naphthaline purification which works so well, so all but automatically among the glass and porcelain of the laboratory, will not work among the bricks and iron of the gas works; but even if it is so to-day it may not be so always. The future has been discounted many times before and has cashed the draft when it came due.

One thing more I think I should say before I bring this paper to its close. I have examined the materials concerned in many naphthaline stoppages—some dozens; yes, some scores—and I have yet to find the first one which was made by naphthaline unaided. When the material obtained from the occluded pipes was cautiously distilled there always without exception appeared a tiny drop of heavy oil whose boiling point plainly showed that it was a mixture of the two highly complex oils which have been so often mentioned in this paper as anthracene and phenanthrene. The amount in any given case was too small to determine surely the percentages of the two in the mixture, but by collecting the residue from about two dozen stoppages, I obtained enough to assert provisionally that the anthracene was in the cases referred to about one-third and phenanthrene about two-thirds. It seems to me that this is a demonstrative proof of the importance not only of getting rid of all superfluity of naphthaline, but also of getting rid of that little drop of oil which forms the nucleus about which is built the structure, at first amorphous, and after some time crystalline, which we may call typical of the naphthaline nuisance. As if to impress upon our minds the importance of this fact let me quote a few lines from a letter I received a few weeks ago.

"Do you know that I am much interested in two statements in your letter. First, that naphthaline stoppings have a nucleus not naphtha-

line; and, second, an experience which agrees with my own, that the most troubles with naphthaline stoppings do not come in the coldest weather? Can it be that oil fog, so fine that we cannot perceive it, sometimes carries heavy oil; because this vapor dissolves more readily when the gas is not well cooled?"

Let us think about this component of the plugs, the tiny drop of oil, and study how large a part this plays in the naphthaline nuisance; such thoughts may be useful some day. We now know how to get rid of the plague and can study the cause at our leisure.

Now, gentlemen, my time is up. I have tried to follow out the scheme suggested to me by your President. I trust that I have succeeded at least this far, that you feel that the time spent in listening to me was not lost. If I shall have succeeded in indicating the lines of least resistance on which we can most successfully do battle with this naphthaline nuisance my purpose will have been accomplished.

On motion of Mr. D. McDonald, a vote of thanks was tendered to Dr. Birchmore for his lecture. On motion, the Association adjourned to reassemble at 2 o'clock, P.M.

SECOND DAY.—AFTERNOON SESSION.

The President called the Association to order at 2:30 P.M.

A COMMENT ON THE BIRCHMORE LECTURE.

Mr. W. E. Steinwedell—I would like to say a word or two respecting the lecture by Dr. Birchmore. I have made a few notes on it. The Doctor certainly treated the naphthaline topic from a chemical and experimental standpoint with great thoroughness, and his presentation will certainly be appreciated by the gas fraternity; but a word might be added regarding the removal of naphthaline from gas as practiced in about 40 works of Europe to-day. Heavy coal tar oil to which 3 per cent. benzol is added absorbs naphthaline until it contains from 15 to 40 per cent. of naphthaline by weight. A small Standard washer, having two chambers, is best used for washing the gas with this oil. The second chamber is filled with fresh oil, and the first with oil from the second chamber, as that in the first becomes saturated. The saturated oil can be run into the tar well where it will thin the tar somewhat, and be sold as tar. Figuring the reagents only, this method of removing naphthaline costs, according to European selling prices, about 0.38 cent per 1,000 cubic feet of gas, but deducting the value of the tar recovered, makes the net cost 0.07 cent per 1,000. Naphthaline is removed after the heavy tar has been separated from the gas, as after the P. and A. condenser, for as the gas is cooled in the washing and scrubbing apparatus, without the previous extraction of naphthaline, the latter is deposited and produces stoppages in the apparatus and in the connecting pipes of the works, as well as in the distribution system of the city. In small works operating without tar extractor the oil can be run through an apparatus similar to a scrubber which will act as a tar extractor as well as a naphthaline washer. Ordinarily about $\frac{1}{2}$ pound of oil is necessary per 1,000 cubic feet of gas. In washing naphthaline from gas the oil is used until saturated. In order to determine this point it is necessary to test the oil at regular intervals, as follows: Place 100 c.c. of the used oil in a boiling flask connected with a Liebig condenser provided with a thermometer. Heat gradually and allow the condensed vapors to flow into a graduated cylinder. The naphthaline comes over between 200° to 270° C., and is caught in a separate cylinder from which the percentage of naphthaline in the oil, as well as the degree of saturation, can be read directly. Naphthaline has also been successfully removed from gas by passing the gas through a purifier filled with sawdust, wet with an alcoholic solution of picric acid. The cost, however, was too great for practice. The careful, concise and progressive manner in which the author has handled his subject is most gratifying and is deserving of the sincere thanks of this Association for the pleasure and instruction afforded.

The President called for the

REPORT OF COMMITTEE ON GASHOLDER SPECIFICATIONS,

which was read by the Chairman (Mr. H. A. Carpenter) as follows:

To the President and Members of the Western Gas Association: The members of your Committee appointed "To prepare standard and uniform specifications for gasholders of the medium and small sizes, in view of eliminating irregularity and assisting managers of smaller plants in checking up gasholder bids," were loath to accept the responsibility, appreciating as they did in some measure the difficulties in the road of success in this direction. However, they did not feel like refusing to serve, as they are believers in the thought that each member should do what he is appointed to do in an institution of this sort, and accordingly accepted the work, hoping to produce something which would be of value to the Association.

The further we got in the matter the more difficult the task appeared, and after much thought and planning, including a consultation with your President, we have decided that it would be unwise for this Association to go into the details of this subject. The various holder builders have spent years in developing their particular type of construction and would not favor any standard specification which might perhaps eliminate some of their special features. Therefore, it seems best in submitting this report to simply lay emphasis on general desirable requirements which could be applied alike to all designs of holders.

There has been much written and said in this connection. We will simply enumerate some of the points again:

It is desirable to limit maximum strain in tension to 13,500 pounds per square inch of least section of metal involved; this may be applied to every part of the structure, tank, holder and guide frame. In the light sheets of the holder shells and crown nothing should be lighter than No. 12 B.W.G., and it is even desirable to make these sheets No. 10 B.W.G.

All cup and grip sheets, as well as top and bottom courses of the holder shells, should be at least $\frac{1}{4}$-inch material.

A good, safe specification for steel plates or shapes would be of basic open hearth steel, of an ultimate tensile strength of from 52,000 to 62,000 pounds per square inch, an elastic limit of at least one-half the ultimate tensile strength, and to stand bending test cold flat on itself without fracture on outside of bent portion.

Particular attention should be paid to the original coat of paint. Use a material which can be easily applied and spend sufficient labor to spread it well on the surface. Respectfully submitted,

H. A. CARPENTER,
W. A. BAEHR,
A. J. STACEY,
} Committee.

The President—I think the report states pretty clearly the object of this Committee to see if some conclusion could not be reached by which different sizes and designs might be eliminated; but, as you see, the work was not pleasing.

On motion of Mr. Miller, the report was received and the Committee discharged with the thanks of the Association.

The President called for the

REPORT OF THE COMMITTEE ON MEMORIALS,

which was read by Mr. Thos. D. Miller, as follows:

During the past year the Association has lost two of its active members, Mr. E. H. Jenkins and Mr. Julius Buss.

Mr. Jenkins embarked in the gas business while still a boy, his first service being with the Indianapolis Gas Company. His advance was rapid and every change brought promotion. He was identified with the gas business at Indianapolis and Elkhart, Ind.; Cedar Rapids, Minn.; Columbus, Ga.; Covington, Ky.; Buffalo, N. Y., and San Antonio, Tex. At the time of his death he was President of the San Antonio gas, electric light and street railway properties. Notwithstanding his residence in the city and State covered only a short period, at the time of his death he was one of the best known and best liked men in the city. Progressive and energetic, he was quickly identified with the interests of the city and State. He was a Past President of this Association, and at the time of his death was President of the Southwestern Gas, Electric and Street Railway Association.

He was well known to us all, and was loved for his genial and energetic characteristics. We can ill afford to lose such a man. The members of the Association desire to express their deepest sympathy with his wife and daughter.

Mr. Julius Buss received his education as an engineer at Dortmund, Germany, his native town. He was an engineer in the Imperial German Navy, and afterwards engaged as an engineer for August Kloenne, of Dortmund, in which capacity he served for a number of years, and then came to this country where he was engaged as an engineer by Mr. Fred. Bredel, of Milwaukee, for the past 14 years. He died at the home of his mother in Dortmund, this being his last wish, and he left Milwaukee only a month before his demise.

He was physically, mentally and socially a big man, and his hearty good fellowship will long be missed by those who knew him and appreciated his many sterling qualities.

It is fitting and proper that this Association should express its profound regret at the loss of such a member, and we desire to extend our sympathy to his mother in her bereavement.

THOS. D. MILLER,
WM. MCDONALD,
FRED. BREDEL,
} Committee.

On motion of Mr. Fitzgerald, by unanimous standing vote, the re-

port of the Committee was received, adopted and ordered spread upon the minutes.

ELECTED TO HONORARY MEMBERSHIP.

The President—The name of a very prominent member of the fraternity, who is known to many of you, has been presented to the Board of Directors as proper for election to honorary membership in this Association. The Directors consider it fitting and meet that such compliment be paid to this gentleman—Mr. Thomas J. Cunningham, senior editor of the AMERICAN GAS LIGHT JOURNAL. The recommendation is placed before the Association for action.

Capt. White—I move that the recommendation submitted to us be concurred in, and that Mr. Thomas J. Cunningham be placed on the roll of honorary membership.

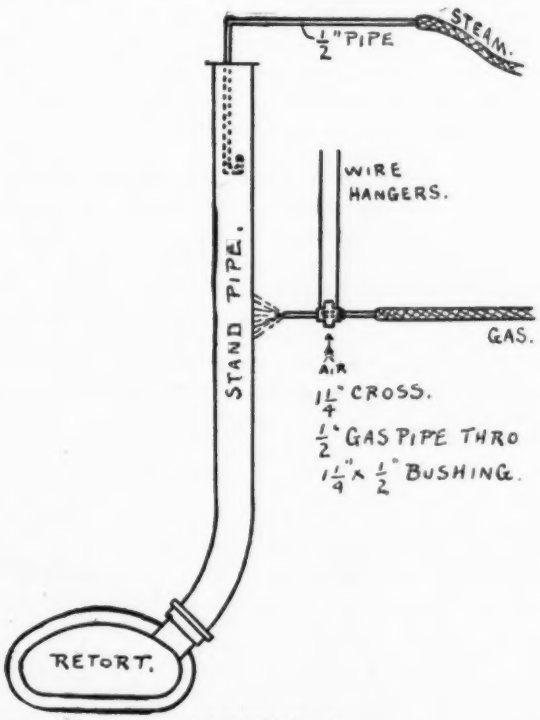
The motion being put to a rising vote, was unanimously carried.

The President then introduced Mr. W. E. Steinwedell, of Cleveland, O., who, as Editor of the

WRINKLE DEPARTMENT,

presented the following budget:

No. 1.—*Cleaning Choked Standpipes.*—Mr. E. C. White, of Long Branch, N. J., sends No. 1, the illustration showing a gas burner for heating standpipes to melt pitch. This burner, made from a 1¼-inch cross, and having gas supplied from the exhauster outlet where the pressure is highest, was applied to a "bad sticker," in which no auger would produce an opening. After applying the heat for an hour the pitch began to run down, and there was then no trouble in running the auger through from the top and thoroughly cleaning the standpipe.



Wrinkle No. 1.

Another good method is to get a small hole through the pitch with a long bar from above, build a wood fire at the mouth of the retort and insert a steam pipe from above, as shown in Fig. No. 1. The pipe is turned up at the bottom, so that when steam is turned on an upward draft is created in the standpipe, drawing the flame and hot air from the wood up through the pitch, causing it to quickly ignite and burn.

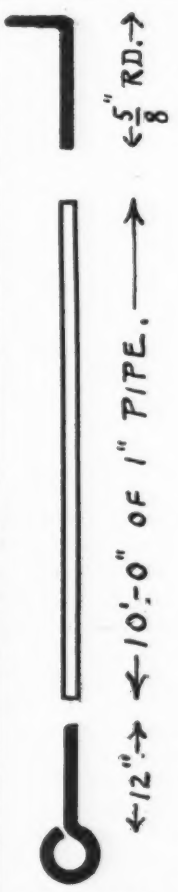
No. 2.—*Coke Rake.*—Fig. No. 2 is from Mr. J. H. Enright, of Carthage, Mo., who describes this rake as follows:

It is made from 10 feet of 1-inch black pipe, which has the handle of the old rake, cut off one foot from the end, welded into it. A piece of ⅝-inch round iron, 3 feet long, is then bent into a proper hook, passed into the other end of the pipe about a foot and welded securely.

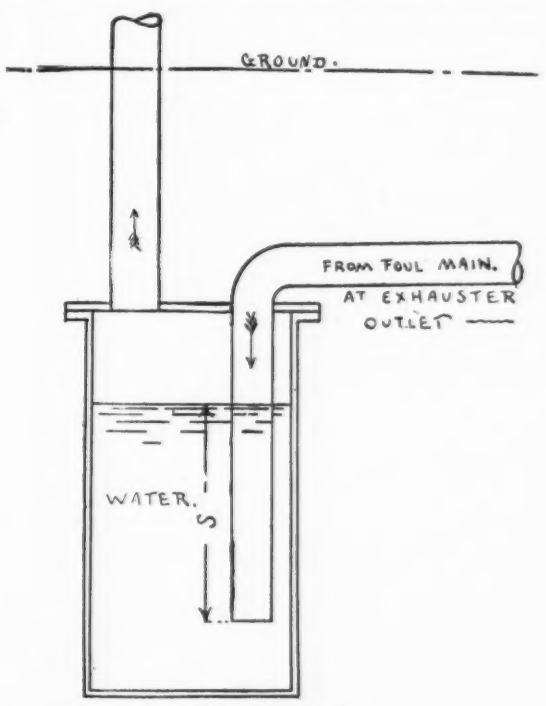
This rake is lighter, does not become heated as quickly, and lasts 3 times as long as does the old-fashioned rake.

No. 3.—*Gas Safety Seal.*—To avoid the possibility of gas escaping in any part of the buildings of gas works, on account of high pressure due to naphthaline or other stoppages, Mr. J. A. Mayers, of New York city, suggests the apparatus shown in Fig. No. 3.

This seal pot, in which *S* is from 4 inches to 6 inches less than any seal in the buildings, is placed in the yard, as far from the buildings or



Wrinkle No. 2.

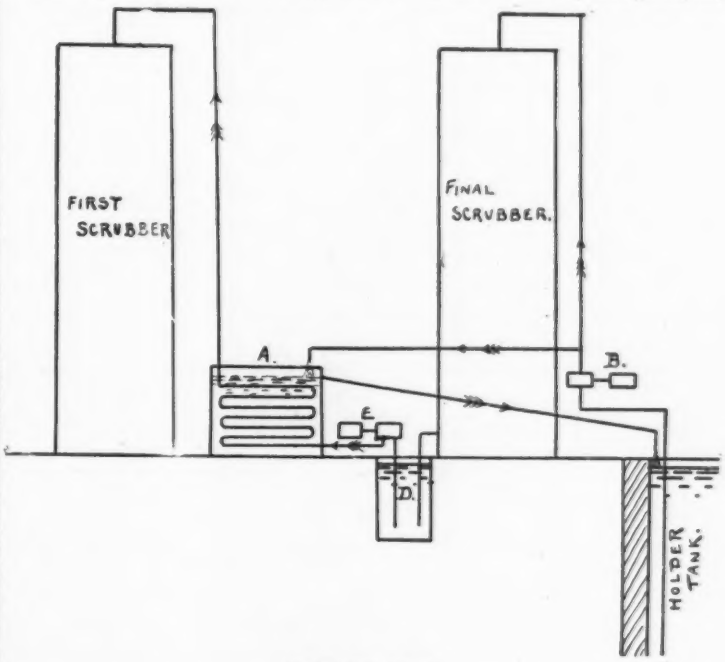


Wrinkle No. 3.

holders as possible. Run a pipe the same size, or a little smaller, than the foul main from the foul main at outlet of the exhauster to the seal, and another pipe of the same diameter, from the seal about 20 feet into the air. The top of the seal pot should be tight.

A U-gauge filled with 10 per cent. sulphuric acid, and arranged to ring an alarm when the danger line is reached (see Ohio Association Wrinkles, 1903), should be connected to the foul main, with the alarm bell placed where men are always at work.

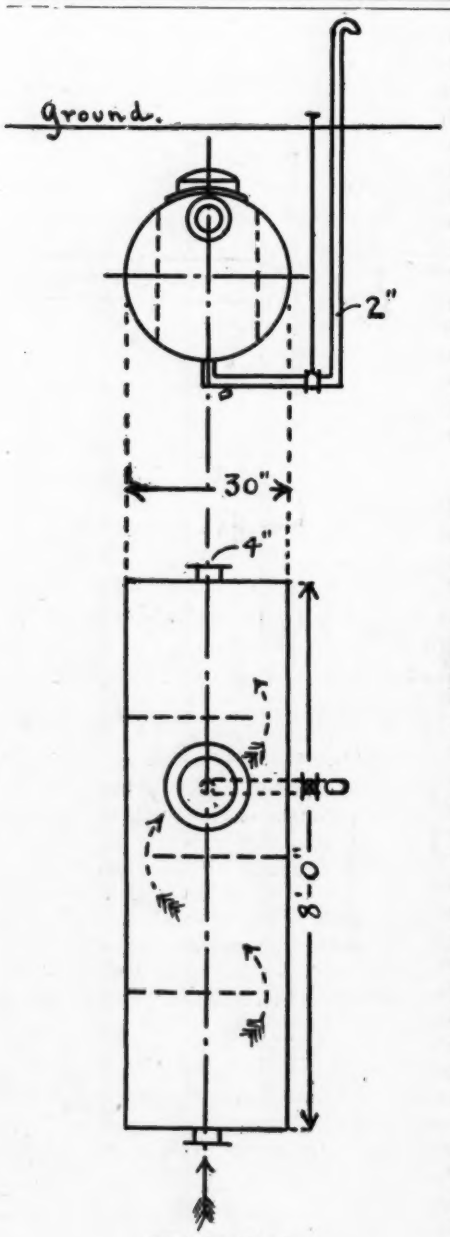
No. 4.—*Cold Water for Scrubbing.*—Mr. L. Fitzgerald, of Cleveland, O., sends No. 4, showing a method of obtaining cold water for scrubbers during the summer months, which increases the yield of ammonia. Water is pumped from the bottom of the holder tank by the pump *B*,



Wrinkle No. 4.

which discharges into the spray of the final scrubber and also into the cooling tank *A*. After leaving the final scrubber the weak liquor is pumped by pump *E* from tank *D*, through the pipe coils in tank *A*, where it is again cooled, into the first scrubber.

No. 5.—*Drip Separator for High Pressure Line.*—Mr. Geo. F. Goodnow, of Waukegan, Ills., has devised the drip separator shown in Fig. No. 5. This was effectively placed close to the works, and consists of a

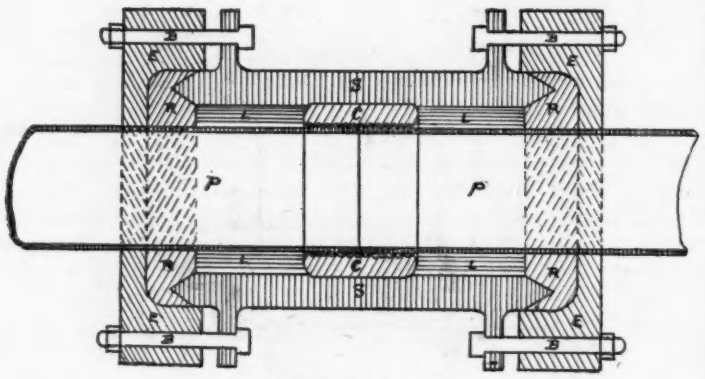


Wrinkle No. 5.

steel tank with baffle plates inside and a manhole on top. The gas enters by a nozzle at one end and passes out the other end to the street mains. The blow-off is taken from the bottom of the tank, having a valve in the line, and passes up to above the surface of the ground. To pump the drip, the valve, which has an extension stem, is opened, and the water is blown out by the pressure of the gas.

No. 6.—*Joints for River Crossings.*—A river sleeve is made which is practically a cast iron screw coupling with rubber gaskets at each end, as shown in Fig. No. 6. In laying a 12-inch main across rivers with this joint, Mr. J. A. Mayers, of New York city, found that the rubber did not keep the pipe rigid and that the cast iron threads gave way. To overcome these difficulties a wrought iron threaded coupling was cast inside the sleeve, and the space between the sleeve and the pipe was filled with lead and caulked. The result was eminently satisfactory under a 200 pounds pressure.

Note the combination of three entirely different joints. The lead serves three purposes: It stops the leaks, keeps the pipe rigid and weights the pipe



Wrinkle No. 6

in the water. Rubber under compression is not readily attacked by gas.

C is a wrought iron threaded coupling cast in the sleeve; *S* is the cast iron sleeve: *P*, the wrought iron pipe; *L*, the lead poured between *S* and *P* and caulked; *R*, rubber ring; *E*, end ring compressing *R* against *P*, *L* and *S*; *B*, bolts.

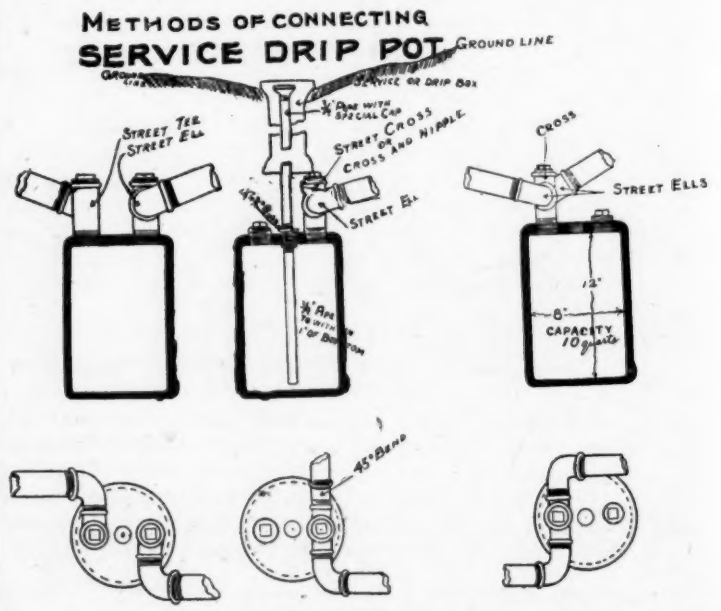
No. 7.—*Improved Tunneller.*—Fig. No. 7 is a rough sketch of a "tunneller," which Mr. Paul Challis, of Battle Creek, Mich., uses in service construction, and also in laying small mains, for the purpose of tunnelling under sidewalks, roadways, trees, porches, flower beds or anything where a pipe is to be laid and it is not desirable to excavate. Each service gang is supplied with one, and the mains' gang with two, one extra being kept to change with others needing repairs. The tunneller

Wrinkle No. 7.

is patterned somewhat after the Champion post hole digger, but is smaller in diameter and lighter, and is used horizontally instead of vertically. The shell or cutter is made of No. 12 or No. 14 tool steel, of which a piece about 8 inches square is rolled in the form of a cylinder, 3½ inches in diameter, leaving an opening on one side of 1½ inches for the ready removal of dirt. The cutting edge of cylinder is slightly "belled" out so as to cut a hole which will clear, and is sharpened, Three fingers are riveted on the inside of the opposite end, and then welded in the end of a piece of 1-inch pipe about 6 feet long. The cylinder has a slight angle with the handle, to prevent running down in sand. In operating it is used with the slotted side up, grasped near the head end, the handle being allowed to drag on the bottom of trench. An intelligent person with a little practice can direct one of these tunnellers with great accuracy and greater speed than the best shoveller can exert in opening a trench of ordinary depth.

No, 8.—*Service Drip.*—Mr. R. M. Searle, of Mt. Vernon, N.Y., sends illustration No. 8, picturing a service drip pot, the object of which is to have sufficient capacity to permit the storage of at least one year's accumulation of drip water and to prevent trouble and annoyance to the consumer, caused by frequent trips to let drippage out of the end of the service from a drip of small capacity, as is usually the case. This drip pot with a pump pipe also prevents the spilling of drip water in the cellar and repeated complaints on the part of the consumer of a leak that does not exist, but that is due to carelessness of the fitters spilling drip water in the cellars.

No. 9.—*Adjustable Pipe Tapping Crow.*—Mr. A. F. Kersting, of Danville, Ky., sends Wrinkle No. 9, which is intended to represent an adjustable pipe tapping crow, adaptable for use in tapping the smaller size mains (3 to 8-inch) with the ordinary sleeve ratchet, where an improved tapping machine is not at hand. It will be seen that the head of the crow is separate from the stem. A collar of sheet metal is rivited the entire length of the head, which fits snugly around the stem, and an extra collar or small band is fitted around the first one, at the base of the head, to add strength to that point where the strain is greatest. A heavy set screw passes through the double section of the collar, by means of which the head is fastened at any desired point on the stem.

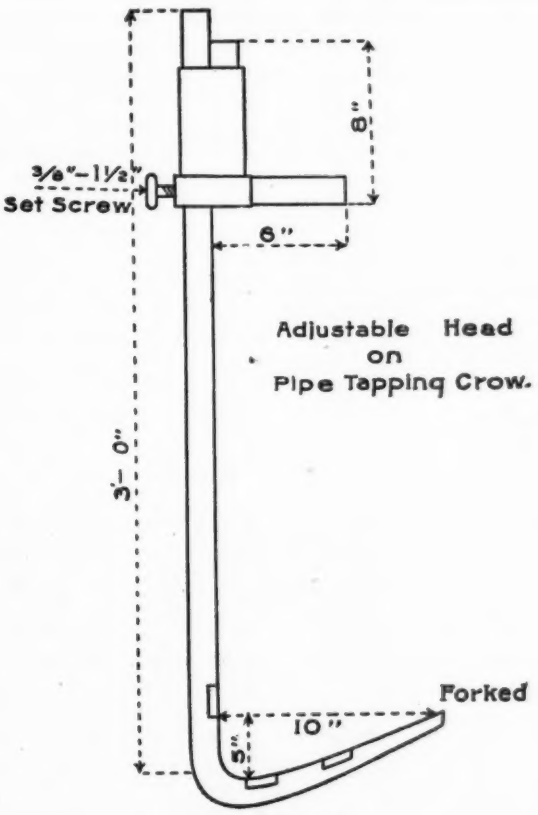


NOTE.—No bushings to be used. Use long nipples and reducing couplings. Suction pipe in all cases to be outside of buildings.

Wrinkle No. 8.

In this manner the same crow can be used on the several sized mains, allowing the head to be placed so that the ratchet and drill fit in comfortably, thus preventing the tendency of the drill to wiggle. Strips welded in the bottom and sides of the heel of the crow also tend to steady the crow on the pipe while tapping.

No. 10.—*Testing New Gas Mains with Air Pressure.*—Mr. J. M. Robb, of Peoria, Ills., states that the Peoria Gas and Electric Company



Wrinkle No. 9.

tests every main extension with air pressure at 10 pounds per square inch. The testing outfit consists of:

1 railway gate pump; 2 plumbers' soil pipe rubber testing plugs to fit the size pipe laid; 1 piece of 1-inch hose, 15 or 20 feet long; 1 pressure gauge; 2 or 3 soap cups, brushes and soap suds.

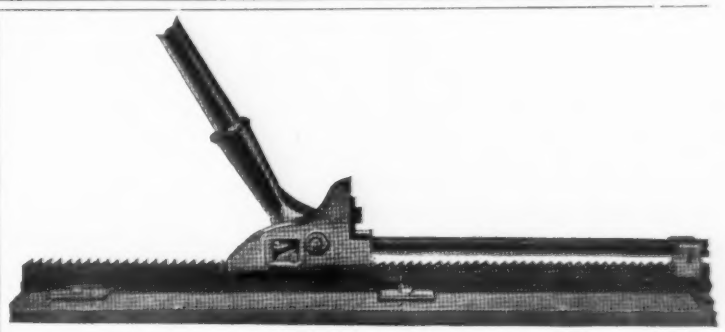
In making a gas main extension the first two lengths of pipe are left out until the extension is completed, and the end of the pipe at the starting point is plugged with one of the testing plugs. When a sufficient amount of pipe is laid, the other plug, with the hose from the pump attached, is inserted in the end of the completed line and the air pressure pumped up to 10 pounds. The joints are then soaped and any leaks found are made good and the pressure is again applied. The tests are continued until the extension is completed.

If the extension is a very long one another break is made in it to avoid the labor of pumping up the pressure on the entire line for each test. When the extension is completed any breaks where the pipe has been left out to facilitate testing are folded in. Then a connection is made between the main with gas in it and the extension with ¾-inch pipe, with a test meter in the connection as a check upon the foreman in charge of the work. Afterwards the first two lengths are folded in and the extension is complete.

In starting with a gang of caulkers who have not been accustomed to the air test a surprising number of tiny leaks, which could not be found by testing with gas at the low pressure under which it is distributed, are shown up; but after a few days' work with the test, the caulkers learn how to drive up the lead so that it is a very unusual thing to find any leaks in the joints.

No. 11.—*Pipe Forcing Jack.*—Fig. 11 shows a jack that forces pipe under ground and dispenses with the tearing up of street crossings, lawns, sidewalks or railroad tracks. It is a device that means a great deal of saving and that dispenses with a great deal of inconvenience and destruction in the tearing up of such places. It is submitted by Mr. T. A. McGinley, of Allegheny City, Pa.

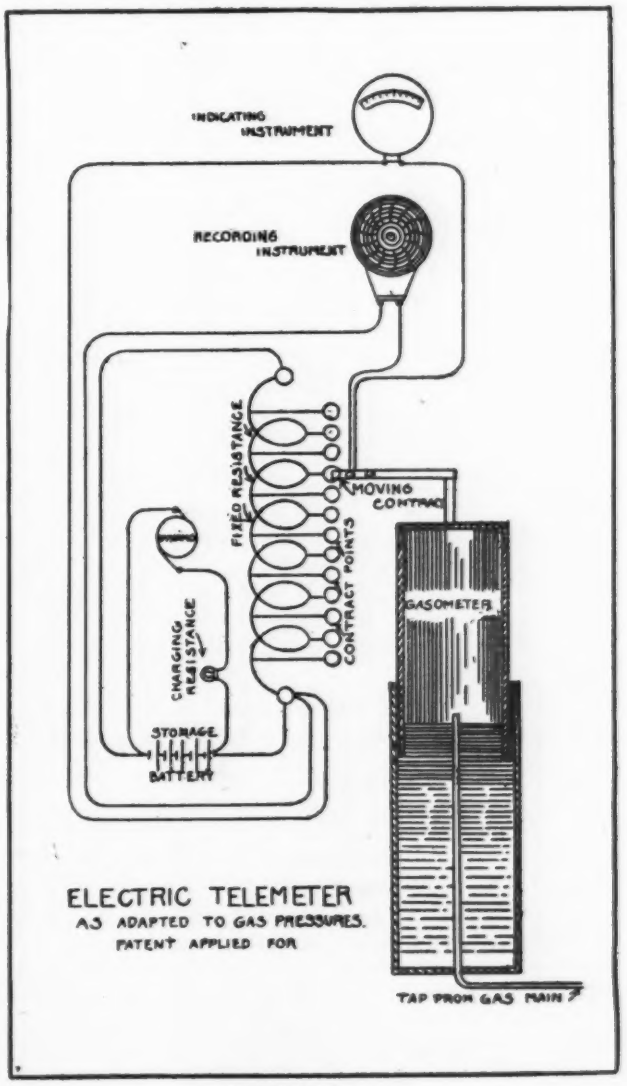
These jacks are made to force pipe in various sizes up to and including 4 inches in diameter, and the results that can be obtained with such a device as this can be easily realized. To operate the jack it is simply necessary to provide a ditch about 8½ feet long in which the jack and rack are placed. A piece of pipe is started in the right direction and forced through the ground 7½ feet, which is the total travel of the jack. The jack is then drawn back quickly to its starting point and a new section of pipe placed in position. The operation is thus continued until the pipe is forced the proper distance. This means that the pipe is cut in lengths of about 7½ feet, which is considerably cheaper than digging a continuous ditch and tearing up ground. A ditch at



Wrinkle No. 11.

the other end is necessary, if the operator desires to make a connection, but the ditch need only be big enough to meet the requirements whatever they may be. Pipe has been forced with this through workable earth a distance of 150 feet.

No. 12.—*Long Distance Pressure Gauge.*—A new and somewhat novel electrical device for indicating at the gas works the exact gas pressure in the street mains at the office building over 2 miles away, has been in successful service for the past 4 years at the office of the Detroit City Gas Company, writes Mr. Paul Doty, of Detroit, Mich. It was invented and designed for this special service, and a patent has been applied for by the inventor—Mr. H. G. Field—to cover its application to indicating or recording at a distance any pressures, positions, volumes or changes of pressure or position. The application may be made equally well to steam, or any vapor, gas or solid. Fig. No. 12 illustrates the connections and circuits as applied to both an indicating and a recording voltmeter.

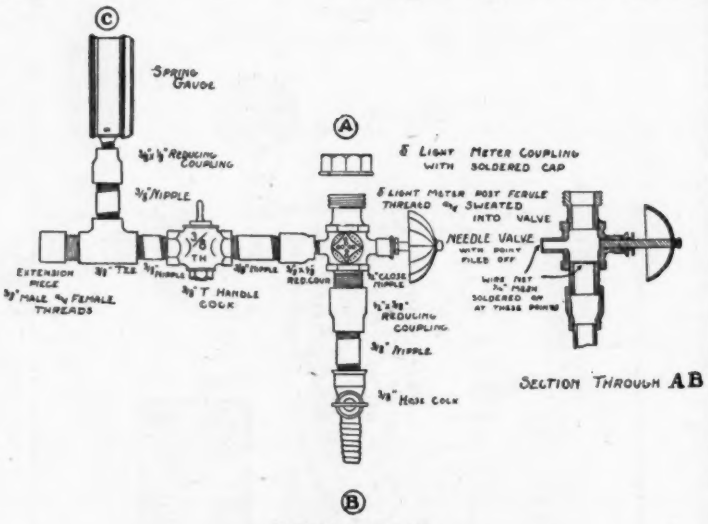


Wrinkle No. 12.

The indicating instrument consists of a voltmeter to measure the drop of potential over a circuit of practically fixed resistance, over which a current of constant value is passing. The current is provided by a storage battery and is maintained constant by being continuously charged by current from a dynamo. The current from the dynamo is

regulated by lamp or other resistance, so that the charging current is just enough in excess of the battery current to provide for the loss in the battery according to its efficiency. A sliding contact is attached to the bell of a gasometer at the gas office. This sliding contact connects with the various segments of a commutator connected at frequent points on the resistance coil. These points are spaced uniformly with respect to the drop in potential. As the contact point moves up and down, due to increase or decrease of pressure in the gasometer, the drop in potential is greater or less, and is so indicated on the voltmeter at the gas works. The voltmeter is calibrated to read in terms of gas pressure as so many inches of water head.

No. 13.—*Testing House Piping.*—Mr. Searle, of Mount Vernon, N. Y., writes that in analyzing the cost of piping houses, a large item of expense is the cost of locating minute leaks. A great deal of time is wasted during the test with ether, and the fact that men get their hands covered with ether and are saturated from the odor given off, dulls their sense of smell, so that it is very difficult for them to locate a leak in another room on account of the etherized air. Fig. No. 13 shows an ether cup to overcome this difficulty. Ether is put in small glass medicine vials and a vial is inserted in the needle valve and the cap screwed on over it. Then a man is supposed to pump up a little pressure and open the ⅜-inch gas cock and at the same time screw up the stem of the needle valve which will break or collapse the bottle. This carburets



Wrinkle No. 13.

the air with ether and avoids any escape of ether or its odor. It has also the advantage of carburetting all the air that passes through the ether cup so that all the gas piping is filled with odoriferous air.

[To be Continued.]

Electrical Apparatus in Coal Mining.

By S. B. Belden, in *Elec. World.*

In regard to the utilization of electricity in mining, some interesting data is given by the Jeffrey Manufacturing Company, of Columbus, O., with respect to new apparatus it is now tntroducing. Miners are now well disposed towards such machinery, but it is said that the public will probably never know the trials and expense attendant upon the introduction of the first chain machines by Mr. J. H. Jeffrey, president of the company. The height of the first machines precluded the possibility of operating them in thin coal, and for several years no attempt was made to build a machine designed for this work. Even after the chain machine was an established success, neither the coal operators nor the manufacturers of the machines believed that a machine weighing over 1 ton could be operated in coal ranging from 32 inches to 36 inches. The standard machine having proven so successful in thick veins, these large machines began to be used in lower coal until finally the minimum vein, so far as these machines were concerned, was reached. One fact, however, was clearly demonstrated, which was that the weight of the machine was not such a serious obstacle. The designers were given the problem and a smaller and lighter machine was brought out by the Jeffrey Manufacturing Company. Its height over all is only 18 inches, but as a truck is essential for moving it from room to room, it is necessary to allow for a height of 28 inches, when so mounted. The total weight of this machine is in the neighborhood of 2,500 pounds, and as it has been designed to have a wide flat shoe board to rest on, it can be moved along the face of the coal by the machine runner and his helper with ease.

The parts are made as light as possible consistent with the work to be performed, but in no instance was a pound of metal sacrificed which would affect either the durability or the strength of the machine. Two steel channel bars and two angle irons riveted to steel cross ties form the outside frame, in which rests an inside sliding frame consisting of a heavy channel, or center rail, to which is bolted the cutterhead. This cutterhead is made entirely of two milled steel plates, which, bolted together, form the front guide for the cutter chain. The chain, which is made of cast steel solid links connected by drop forged straps, passes around idlers, or sprockets, located at each side of the cutterhead, and then along the chain guides to the rear of the machine, where it receives its power from a third sprocket located under the motor. The motor is of the iron clad multipolar type and was designed especially for this low vein machine. The motor rests upon a steel carriage which forms the bearing for the main shaft. A feature, which is essential to the successful operation of low coal, is that the thin vein machine is equipped with a self propelling-truck. Where the grades are heavy this truck operated by the mining machine motor is of extraordinary advantage, and where the room lies to the dip it obviates the necessity of brushing down the roof for the mules.

Many mines now having only 28 inches to 30 inches of coal are being operated entirely by the thin-vein machine. While the data received from these different mines varies, owing to the local conditions, it is safe to say that a fair average will show these machines to be capable of under-cutting at least 50 tons of coal per shift. Nearly all of these plants work two 8-hour shifts, so the output of a machine working in such a vein can be considered as 100 tons per day. Four hundred tons represents the daily output of many small mines and it might not be amiss to show the approximate cost of an electric plant of this capacity.

The average amount of power required by each machine has been estimated to be about 15 kw., so a 75 kw. dynamo would furnish sufficient power for the simultaneous operation of four machines and still have excess power for electric lights or for small motors, which might be added for pumping or ventilation. In order to have at all times sufficient boiler power I would recommend a 72 × 18 150-horse power return tubular boiler. At first glance this would seem to be too great an excess of boiler power, but actual experience has demonstrated that this proportion is more economical in the end. The following machinery then would be necessary for a plant to produce 400 tons of coal per day in a 3-foot vein of coal: One 72 × 18 return tubular boiler, one duplex boiler feed pump, one feed water heater, one injector, one set of steam fittings, one 13 × 14 simple automatic engine, one double leather dynamo belt, one 75-kw. generator, one marble switchboard and instruments, one complete station equipment, four low-vein machines, four self-propelling trucks for the same. Approximate prices: Plant, $4,100; four machines, $4,000; four self-propelling tracks, $400: total, $8,500.

To this price would be added the cost of the foundation, the cost of installing the machinery, and the cost of the necessary copper wire to conduct the electric current from the power house into the mines. It is safe to figure on $10,000 covering the necessary expenditures for this plant.

It is difficult to say exactly what the depreciation of an electric plant is, and it is even more difficult to say what the depreciation of a chain machine is, for the first Jeffrey mining machines put on the market over 25 years ago are still in daily operation. A large amount of data received from various mining sections bearing on the cost of mining machine maintenance per ton of coal cut gives figures ranging from one-tenth of a cent to two cents per ton. One can easily appreciate the variation of these figures by considering first the quality of the coal being mined, and second the care which is taken of the machinery. It is only natural that a hard coal full of sulphur in the "bearing in," will cost considerably more per ton to mine than a soft pure coal. It is also true that two machines working in the same territory or even in adjoining rooms, will show a difference in the cost of repairs, which can be

traced to the different attention or care which they have received from their respective runners.

I have before me the mining scale recently adopted in number eight vein of Ohio coal. This scale gives: Pick mining in rooms, 90 cents; machine mining in rooms, 11 cents; loading after machine in rooms, 52½ cents.

This shows a difference between the two methods amounting to 26½ cents per ton. The 4-machine plant figured on should produce at least 75,000 tons per year. If we allow a depreciation charge on the plant of 10 per cent. of its cost per year and 6 per cent. for the interest on the investment, and add to this the cost of producing the power (which our data sheets give as $1\frac{9}{10}$ cents to $2\frac{1}{10}$ cents per ton) and the largest cost of repair parts which we have ever known we still have a net saving of over 13 cents per ton. In other words, a plant of this kind will practically pay for itself within one year, by the net savings of the difference between the cost of the chain machine mining and the pick mining.

The Jeffrey Manufacturing Company builds electric locomotives in weights ranging from 2 to 30 tons, and, as with its mining machines it has designed special locomotives for operating in low coal. The dead work in the entries necessary to get sufficient height for mules in low coal mines, often adds no small amount to the cost of the production. The special low-vein locomotives were designed with a view of saving this roof brushing. The local conditions in the different districts govern the amount paid for such yardage, so it is difficult to name any definite amount which can be saved. However, I am familiar with one mine where the amount was $2.80 saved for every yard of entry driven. In this particular mine the strata instead of being level was rolling, and grades were encountered on the butt entries ranging from 2 per cent. to 7 per cent. By the introduction of a low-vein locomotive the operators were able to displace 8 mules and 4 drivers. Counting each mule as costing 35 cents per day and the drivers $2.25 apiece, and deducting the pro rata share of the plant expense for the locomotive, they figured that they saved $8 per day by its use. Locomotives weighing 4 tons have been built by the Jeffrey Company, having a height over all of only 29 inches. These are fitted with wheels outside of the frame and have a small enough wheel base to admit of their operating on any curve around which a pit car will pass.

The heavier locomotives have a greater total height. One has the following dimensions—it weighs 24,000 pounds and has a total height excluding the trolley of 39 inches, the length over all is 9 feet 4 inches and the wheel base is 40 inches. It is designed to have an operating speed of from 6 to 10 miles per hour, and will handle a gross train load of 150 tons on a level track at this speed. The Jeffrey Company has recently put out a locomotive which is fitted with a new device. The object is to enable the locomotive to reach the face of the coal in the rooms without using a trolley wire. As the rooms are continually being advanced the cost of wiring them and of keeping the wires within working distance of the face would be considerable. This new locomotive receives current through a cable, one end of which is connected to a junction box on the entry outside of the room neck. The cable is wound on a reel which is mounted on one end of the locomotive, and the current passing through the cable is conducted to the motors. As the locomotive leaves the entry on its way into the room the cable unwinds from the reel. When the locomotive starts out of the room with the loaded car, the cable automatically rewinds itself on the reel. At the junction box in the entry it will be entirely rewound, and the locomotive can again proceed with the current taken from the trolley wire.

The cost of adding a locomotive to an electric mining plant already in operation is but very slight as compared with the result which can be obtained. It is, therefore, advisable when installing a machine plant to provide for excess power if there is any possibility of using electric haulage in the future. The hauling being all done during the day shift, when a new plant is being installed it is considered economical to design it on the basis of operating more machines during the night shift and thus give the locomotive and a few machines the power during the day.

Such an arrangement cuts down the initial cost of the power plant and seems to give absolute satisfaction. For instance, to consider a plant capable of cutting and hauling 1,000 tons of coal per day from a 4-foot vein of coal. The cost would be about $15,000 f.o.b. cars factory. Six of the machines would be worked during the night shift and four of them could alternate on the day shift. In this manner they would give the output required. A locomotive such as specified above would be capable of hauling 117 tons gross train load on a level track at 8 miles per hour, and unless the grades were unusually heavy in the mine it could have sufficient power to produce the output figured on.

Lost and Unaccounted-for Current.

[A paper read by MR. L. G. VAN NESS, at the last meeting of the National Electric Light Association.]

When this subject was assigned to me I hoped to be able to present a tabulation of records showing lost and unaccounted-for current from a number of stations, but I was disappointed in getting some of these records. Instead of a tabulation of results, I will only attempt to discuss the subject in detail and try and show how the different elements may be calculated and to what use this information may be put once it is determined.

This may not be as interesting to central station men who now know what their lost and unaccounted-for current is, but it will be of more value to those who do not know, if they will attempt to apply the methods to their own conditions.

Lost and unaccounted-for current in high tension transmission lines will not be discussed here, as an inductive drop plays an important part and a study of conditions of existing lines would probably reveal embarrassing errors in original design which were practically unavoidable at the time the design was made.

The study of lost and unaccounted-for current in distributing systems is not only interesting work, but it almost invariably brings to attention conditions that can easily be remedied and the efficiency improved thereby.

Lost and unaccounted-for current in alternating distributing systems may be classified under four heads:

Transformer iron loss; resistance loss; meter shunt loss; unaccounted-for current.

For direct current distributing systems lost and unaccounted-for current may be classified under three heads:

Resistance loss; meter shunt loss; unaccounted-for current.

These headings will be described briefly and I shall endeavor to show that the losses may be accounted for, and that this accounting will, in itself, suggest means to reduce the loss.

Transformer-core loss is very easily calculated by multiplying the loss per transformer times the transformers in circuit, times the hours of operation, when the transformers are all of the same size. When various sizes are used it may be calculated for the different sizes and footed for the total. If transformers have not been tested in the testing room the makers' guaranteed loss may be used if due allowance is made for aging of the cores. An allowance should also be made for the voltage under which the transformers are operated, if makers' tests are not at the same voltage at which transformers are operated. Within small limits core loss will increase about 2 per cent. for each 1 per cent. increase in voltage over tested voltage. A comparison of two districts, one supplied by isolated transformers and the other by individual transformers, will at once give us an idea of how much money might be spent to install a 3-wire secondary system, as much less transformer capacity will take care of the same load in 3-wire network than with isolated transformers. In case of very large installation near the shop it may be advisable to make arrangements to cut out certain transformers during period of light load. In case there is practically no morning peak a portion of the transformers may be cut out at 10 or 11 P.M. and left out until dusk of the following evening.

A comparison of the cost of generating this particular amount of current for that time with the cost of labor incurred in cutting out and cutting in transformers, would determine whether or not this would be a profitable arrangement. Remote control switches have been proposed for doing this work, but as it is necessary to cut out both primary and secondary of a transformer on a 3-wire system, the switching apparatus becomes complicated, and it is doubtful if this may be done profitably.

Resistance losses may be calculated in several ways. The simplest, and probably the most satisfactory way, is to compare the average voltage of the lamps on a circuit with the voltage carried at the station as determined by station records. This will show a certain variable difference in voltage due to the load on the station at any particular hour. This difference in voltage represents the CR and reactive drop of the feeders, which, multiplied by current carried by feeders at the same time and the power factor of the circuit, will give us watt loss in our distributing system for that particular load. This may be calculated for as many different loads as is thought advisable, and the summation taken for an average day of the period. The information necessary for all this calculation is available in almost every station, as indicating ampere-meter readings are usually taken at intervals of one-half hour or hour, and every central station man will claim that his lamps are run at very nearly their rated voltage.

There is another and more complicated way of calculating resistance losses, which may be used to check the method described previously. The loss in the feeders may be calculated by taking size and length of feeders and calculating the C^2R loss for one ampere flowing to the first point of division. From this point to the end of the circuit, if the one ampere is considered as dividing in proportion to the connected load on different branches, the C^2R loss may be calculated accurately to the end of the feeders. From this value per ampere the all-day losses may be calculated by taking the station ampere-meter readings at intervals during the day and squaring them and multiplying by the loss per ampere. By taking the station output for the same period, a certain relation may be established between the C^2R loss and the output of the station. This ratio may be applied to the output of the station for the period, to determine resistance losses for the period. It must be borne in mind that the losses increase or decrease in proportion to the square of the output.

Secondary losses may be calculated in the same manner, and transformer resistance losses may be calculated by using the rated loss at the load carried by the transformer at different periods of the day. This process is somewhat tedious, and I think the first method will give the resistance losses full as closely as the second method, and it has the advantage of being rapid and requiring very little data.

The cost of furnishing this current that is lost in the feeders will furnish an indication of the time when it will be proper to make an expenditure to reinforce the lines. If all feeders are carried on one 'bus bar and feed independent districts, it may be necessary to consider also a feeder regulator to overcome excessive drop due to increase of business in one district. The figures to compare are, then, interest and depreciation on reinforcements, cost of resistance losses, and cost of regulator losses.

Meter shunt loss is calculated by determining by test the losses of each type of meter and each size and multiplying the result by the number of each type and size.

Meter shunt loss, while not considered serious, will sometimes show more than transformer iron loss. This is quite possible in a residence district fed by a carefully designed secondary network. Many small consumers may be served by small transformer capacity, but they require a meter per consumer, and, unless losses are small per meter, the total loss is a serious item. The only means of reducing this loss is by installing meters with less loss per meter, or by using ampere-hour meters. It has occurred to the writer that if meter manufacturers would devote as much time to developing an ampere-hour meter as they spend trying to improve the watt meter they might produce a meter that would serve our purpose much better. We all claim that we give good regulation, and if this is true we can calculate the consumption for alternating incandescent load as accurately with a correct and sensitive ampere-hour meter as it can be measured by a watt-meter. We should then eliminate a loss that amounts to from 16 to 36 kw. hours per year per consumer.

The unaccounted-for current is all that we are unable to trace accurately. This includes faulty registration of meter, elimination of meters from the records, theft of current and leakage by grounds in underground systems. There is really no good excuse for losing records. However, it sometimes happens, and the only way to check this is to go over the districts covered, counting connections and comparing with the number of consumers shown by the ledger.

The resistance losses for the direct current system should, I think, be calculated by the first method given for alternating system. If we attempt to calculate it by the second method the problem is almost endless on account of interconnecting feeders and mains. The only error that can appear in calculation by the first method is error in assuming the voltage at which the lamps are operated This should be checked by numerous tests at all hours and over the entire system. It is not sufficient to assume that lamps are run at rated voltage because the management claims that they are giving an average regulation within a certain per cent. It is possible that a test for this purpose will develop some deficiencies in regulation that are not suspected. The following are some figures on three representative circuits:

TABLE I.—*Showing Data on Three Feeders and Losses on Same.*

	1.	2.	3.
Voltage	2,000	1,000	1,000
Connected load, kilowatts	337	461	351
Maximum demand, kilowatts	176	81	88
Number of transformers	12	15	145
Cap transformers, kilowatts	130	135	160
Number of meters	182	266	308
Trans. iron loss, per cent	3.6	15.4	42.7
Resistance loss, per cent	4.5	6.5	6.3
Meter shunt loss, per cent	.8	5.2	1.4
Unaccounted for, per cent	13.3	1.7	1.1
Sales, per cent	77.8	71.2	48.5
Output, per cent	100	100	100
Output, kw. hours	35,386	9,135	20,100

The first is a well-designed feeder supplying a business district on a 3-wire network.

The second is a carefully designed feeder supplying a residence district on a 3-wire network.

The third is a feeder with isolated transformers, such as we often find, that has been added to from time to time, and no attention paid to economy of operation. This feeder supplies a mixed residence and business section, and could be, and was, made with very little expenditure an efficient distributing system.

It may be noted that between feeders 1 and 2 the transformer iron loss is 3.6 per cent. for No. 1 and 15.4 for No. 2. The actual watts lost in No. 2 are more than the watts lost in No. 1, but the lesser sales, due to its being a poorer district, raise its percentage of iron loss.

The meter shunt loss shows less, both in percentage and watts, for feeder No. 1 than for No. 2, for the reason that the consumers are fewer in number and the consumption greater.

The unaccounted-for current shows an abnormal amount under feeder No. 1, which indicates that there is some theft of current in that section. The natural course to pursue would be to check up all meters in that district, and, if no large meters were found dead, then it would be necessary to begin a search for taps taking current without measurement.

Feeder No. 3, while it appears to a great disadvantage beside Nos. 1 and 2, is by no means unusual. There are many operating under the same conditions to-day, and few realize the cost of this operation. For instance, the iron loss in this feeder amounts to 8,600 kw. hours per month. This, at the generating cost of 1 cent per kw. hour, amounts to $86 per month, or $1,032 per year.

TABLE II.—*Showing Legitimate Losses on Five Carefully Designed Feeders Supplying all Classes of Business.*

Voltage.	Trans. Iron Loss—Watt Hours.	Trans. Iron Loss—Per Cent.	Resistance Loss—Watt Hours.	Resistance Loss—Per Cent.	Meter Shunt Loss—Watt Hours.	Meter Shunt Loss—Per Cent.	Output. Watt Hours.
1—1,000	28,488	6.76	23,923	5.68	14,916	3.54	421,000
2—1,000	19,752	3.78	25,086	1.98	19,002	3.65	522,400
3—1,000	28,680	9.56	17,026	5.60	23,316	7.77	300,000
4—2,000	20,712	5 01	29,691	7.28	24,504	5.93	413,000
5—2,000	42,576	8.55	28,867	5.79	18,720	3.76	477,600

Table II. shows output and losses for an average winter day for 5 feeders, which have received considerable attention in the way of design. There is but one peculiarity in these figures, and that is that in feeder No. 4 the meter shunt loss amounts to more than the transformer loss. This is due to the fact that the feeder supplies a residence section by a carefully designed 3-wire network. The conditions here were such that the transformer capacity could be so installed that very little more than the demand of the feeder was necessary in order to give proper regulation. On account of the large number of consumers, it was impossible to keep the meter shunt loss down without using ampere hour meters.

TABLE III.—*Showing Lost and Unaccounted-for Current for a Station for the First Three Months of Analysis.*

	Trans. Fe. Loss.—Kw. Hours	Trans. Fe. Loss.—Per Cent.	Resistance Loss.—Kw. Hours.	Resistance Loss.—Per Cent.	Shunt Loss—Kw. Hours	Shunt Loss—Per Cent.	Unaccounted-for—Kw. Hours.	Unaccounted-for—Per Cent.
Jan.	29,296	14.3	7,849	3.76	7,486	3.58	43,205	20.6
Feb.	26,163	14.5	6,588	3.66	6,625	3.68	36,096	20.1
Mar.	28,153	16.9	4,377	2.62	7,121	4.28	23,958	14.4

Table III will give an idea of some of the things that we may learn by an analysis of lost and unaccounted-for current for an ordinary station. This shows analysis for the first three months. It will be noted that transformer iron loss remains practically the same. The party making this analysis states that it will be cut something like 10,000 kw. hours per month in a very short time. This is not entirely due to the analysis of the lost and unaccounted-for current, as the requirements of the service demand an improvement in this line.

The resistance loss has been decreased by very little expenditure, simply because they found where the resistance loss took place.

They do not expect to reduce the meter shunt loss, but the unaccounted for current has been reduced about 45 per cent. in three months. This was accomplished by looking up lost records, defective meters and thefts of current.

The party making this analysis, in reporting, says: "The work necessary to make this analysis easily pays for itself many times over, as it is very probable that we should not have discovered the theft of current or loss of records had it not been brought to our attention in this forcible manner."

These figures are not cited as representing average conditions. However, there are many sections to-day with alternating distributing systems in no better condition than this one was in January. While an analysis is not always necessary to get a station in good condition I maintain that the information brought out in analysis of this kind will assist us greatly in tracing out inefficiencies that can easily be remedied.

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

LONDON, ENGLAND, June 10th, 1903.

The Institution of Gas Engineers.—The Future of the Gas Industry.—Treatment of Residuals.

The meeting of the newly organized Institution of Gas Engineers, built upon the ashes of the now defunct Gas Institute, is in full swing, but it is too early yet to draw many conclusions as to the prospects of a successful future, as indicated by this the first meeting. The programme, so far as the contributions of the ordinary members are concerned, is a very thin one. There is the usual President's address and a lecture by Prof. Lewes, but apart from these only seven papers. And more than one out of this small number bears signs of having been provided by

request or through personal influence. Four of the authors live in London and one on the Continent, so that the proportion taken by the actual rank and file of the members comes out very poor indeed, and unless more evidence of a sense of responsibility in regard to personal interest in the proceedings is forthcoming, the future of the Institution is not hopeful. As usual, all this time we hear of the committee who opine that their gas manager might as well save himself the trouble (and them the expense) of attending the meeting of the Institution, when he can obtain full reports of the proceedings, and it is unfortunate when the scanty nature of the agenda is such as to favor such arguments. It has been aptly remarked that if everybody held these opinions there could be no proceedings to report. As it is, provincial gas managers find only one representative in England and one in Scotland, and the members should be appealed to with a view of preventing this cause of reproach in future.

The order of proceedings follows the usual stereotyped character well known to habitues of the Institute meetings. There are morning sittings only, lasting from 10 to 2, leaving the members free for the remainder of the day, on Tuesday, Wednesday and Thursday, and an excursion to Eastbourne on Friday. The preliminary proceedings include the election of five honorary members, Sir Geo. Livesey, Prof. Lewes and Messrs. G. Bray, T. Fletcher and J. Hepworth. As to the wisdom exhibited by the council in their choice of candidates for honors, there is not likely to be two opinions. The good work done by each of the gentlemen named is notorious as being well worthy of any complimentary recognition that the Institution have power to bestow. The Presidents' evening conversazione is to be continued on this occasion. It is an agreeable social function that appears to have entirely displaced the annual dinner. I don't know whether you can manage better in the States, but our official banquets here, for anything over 200 covers, are of a fearfully dreary and prosy character. An hour or two is lost amid an infernal clatter that renders conversation impossible, the guest gets a small platter containing just a taste of something or other with a foreign name to it, about every 20 minutes, and then comes the speeches. Fortunately at this period one is allowed to smoke, and provided the precaution has been taken of laying in a substantial lunch early in the day, is ready for such enjoyment. A good cigar and a little high-class music render the remainder of the evening passable. As for the speeches, a large proportion of the speakers don't know what to say, and a larger percentage cannot make themselves heard. An Irishman is said to have enjoyed an annual festival so much that he proposed to have one twice a year. I go the other way with the annual banquet. One in 10 years is about often enough.

I have previously remarked on the similarity of ideas on both sides of the Atlantic, and how it frequently happens that the same topic is discussed by independent Associations in both hemispheres on or about the same day. Another instance in point is that of the future of the gas industry which has lately received some attention both here and in America. It is interesting, by the way, to note that practical men agree that there is a future for gas, because some authorities, more noted for general than for special knowledge, say there is not. Mother Shipton said that the world would come to an end in 1881, and in 1876 and 1877 some people were saying that in four years gas would be displaced, which was rather superfluous. The people who talked so glibly about gas plant and old scrap as likely to be synonymous terms in 1881 are not now in evidence, and the most sanguine of them would be now willing to grant the industry a considerably longer lease. But there appears to be a kind of unrest amongst those who have had practical experience in the supply of gas during the last 10 years, and who have had some practical experience or knowledge of the Lowe carburetted water gas, the Lewes process and other novelties on the works, and of incandescent burners and old meters in the district. People who formerly pinned their faith to a good, honest 16-candle gas, now have a greater belief in a cheap article of good calorific power, photometrical value not much account, whether 14, 12, 10 or even 8-candle. Practical evidence of this movement is shown by the recent reductions from 16 to 14 or 13 candles, made on the Parliamentary standard for the supply of gas in London. Professor Lewes is to lecture before the Institution of Gas Engineers to-day on the subject of "Candles and Calories." This gentleman, being the chief gas examiner to the City of London, is in a position to witness more of the trend of thought as above indicated than any other man in or out of the profession. He has been working for some few years on the idea of increasing the yield by the ordinary retort process, by the very simple expedient of passing blue water gas through the retort, with the double object of taking up the excess of illuminants at the beginning of the charge and of preventing decomposition with formation of carbon, naphthaline, etc., towards the end, the result being an increased yield of an increased sperm value. The one English representative of Provincial Gas Managers, Mr. S. O. Stephenson, of Tipton, on the list of papers is to discourse on practical experience with this process. Other processes having similar objects in view, viz., an increased yield of possibly lower quality gas, are in the air, and it was hoped that at least one of them would have been forward enough for publication. It may be safely prophesied that the gas industry is entering upon a new era, that radical changes will take place in more than one department, and that the enlargement of output that has been a marked feature for some years will be an increasing rather a decreasing quantity.

Another direction in which progress is notable is in regard to the treatment of residuals. I do not allude to chemical processes, such as the manufacture of sulphate of ammonia, or the fractional distillation of tar, but to the mechanical separation of coke and ashes into various salable sizes. Until comparatively modern times the majority of gas engineers were satisfied to sell their coke for what it would fetch, and to accept nominal prices for the breeze, ashes, clinker and broken brick, if they did not actually give them away. Then came the use of the coke breaker for preparing household coke. It was found that even at low terms the yards could not be kept clear, and attempts to dispose of the surplus for household purposes were met by the objection that it was too big and that people objected to the trouble of breaking it. One enterprising gentleman designed a specially shaped kind of hammer for this purpose, and presented one as a bonus to every purchaser of a load of coke. But when the public found that they could obtain household coke, the demand was so extensive that a large retail trade sprang up, and the booking of orders and delivery at the premises of the consumer became an established thing. This process was attended with one objection and that was an increase in the residue of small. But it was found that a market existed for this at a somewhat reduced but still a not despicable price. With the advent of good Portland cement on the market it was found that clinker, burnt brick, etc., is in demand for the manufacture of concrete, and that if builders would not pay a reasonable price for it, a good plan was to put it by against the time of the next large gasholder tank or new retort house. Lastly, the fine screenings of all kinds could be turned to account for the manufacture of tar pavement. Many gas works are now running all these departments, with the result that large stocks of residuals are a rare occurrence and that the accumulations during the heavy season are all cleared before midsummer, and that without any sacrifice in the matter of price.

The considerations are suggested by an interesting description in last weeks *Gas World*, of a set of machinery as erected at the East Greenwich works of the South Metropolitan Gas Company, for the purpose of washing, screening, and sorting pan breeze, and automatically taking out the clinker, thus replacing a laborious, costly, hand process. The apparatus is arranged on an elevated floor and comprises a revolving cylindrical screen, two long troughs or races fitted with endless conveyors, and overhead hoppers from which the various materials can be loaded. The screen comprises two sizes of mesh, from which two qualities of small are obtained, and the residue that does not pass through the screen consists chiefly of fairly large coke and clinker. Advantage is taken of the difference in specific gravity to separate these by a rushing stream of water which carries off the light coke and leaves the heavy clinker. There are arrangements for freeing the coke from small or dust, and many other details that cannot be particularized in a short cursory notice, and the machinery is actuated by a 12-horse power gas engine. It is estimated that the cost for labor will be less than 1d. per ton, and that the total cost, including interest on capital and depreciation, will not exceed 3d. per ton. These figures are sufficiently tempting to secure a place for machinery of this kind in all large works.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

MR. F. H. SHELTON, writing to the JOURNAL under date of the 22d inst., says: "In further reference to the output per capita of gas companies in small towns, and the recent letter concerning the sales in Media, Pa., it may be of interest to note that in the Borough of Lansdowne, also of residential character, near Philadelphia, and without manufacturing interests, on a population of 3,500 people, the Suburban Gas Company, of Philadelphia, for the year ended May 1st last, sold 12,324,000 cubic feet. This is in the face of two electric companies in Lansdowne, one of which is a local concern. The price of gas is $1.25; there are 533 consumers, and 8½ miles of pipe."

"H. R. C.," WRITING to us from Philadelphia, under date of the 19th inst., incloses the following: Gas has been put into the Poe cottage, at

Fordham, N. Y. Such an improvement in the poet's time would have made it impossible for him to write *The Raven*, but his thoughts might, nevertheless, have found some equally metrical form--like this, for instance:

In that capital of Boredom, which is known to fame as Fordham,
Where the brawling Bronx breaks bravely on its shingly, shelving shore,
Once—Oh, recollection bitter!—came a gruff and grim gasfitter,
Knocking with a pair of pipe-tongs—knocking on my chamber door.
"Wretch!" I savagely inquired; "don't you see that I'm inspired;
Don't you see I'm writing poems like no man has writ before?"
"Say! I've come to set a meter!" said the man, and I, discreeter,
Let him in, although I mumbled as he stumbled through the door:

"Set a meter? Why in thunder do you set one here, I wonder?"
"That's my business, setting meters, I have set them by the score,
All my plagiaristic brothers borrow mine and use no others,
That is what, in their opinion, I invent my meters for."
But the man, with tongs and hammer, fell to work amid a clamor,
Breaking pipes, while his apprentice sauntered to the shop for more,
And in eight distracting hours, said: "She's finished, be the powers!"
And, departing, left the meter perched above my chamber door.

"Troth," I said, "a merry meter, how could anything be sweeter?"
As I listened to the whirring of the wheels that raced and tore.
And I left the jets all burning so the wheels could keep on turning,
And, inspired by their music, reeled off poetry galore.
But ere long a bill collector came around to nag and hector
Me for money, and I learned from him a thing whereat I swore—
Every single revolution forced from me a contribution
To the Gas Trust of the magnitude of ninety cents or more.

"Turn it off!" I shrieked in terror. "Better is the gloom of error.
Better is the deepest pit upon the night's Plutonian shore
Than this light, whose gloom-dispelling my expense account is swelling
So that even Rockefeller would go broke against the score."
But, though no more gas was burning, still the meter kept on turning,
Churning, easy money earning, for the Trust's o'erflowing store,
Still it sits there ticking, clicking, and wherever I go kicking
To the Trust to choke it off they answer calmly "Nevermore!"

JAMES MONTAGUE.

MR. F. D. MOSES, of Trenton, N. J., has been awarded the contract for the new plant that is to be constructed this summer at Albert Lea, Minn. The contract embraces everything save the generating apparatus, which is to be installed by the United Gas Improvement Company.

ACCORDING to the Boston *Herald* of recent date, Governor Bates has decided to appoint the Hon. Samuel W. George, of Haverhill, to succeed Mr. Chas. N. Gifford on the State Board of Gas and Electric Light Commissioners.

THE Massachusetts Board of Gas and Electric Light Commissioners has assented to and approved the application of the Great Barrington Electric Light Company for an issue of new capital stock of the par value of $26,200 and of bonds in the sum of $10,000.

THE City Council of North Yakima, Wash., has granted a franchise for the right to construct and operate a gas works in the named place to Messrs. Chas. B. Hurley, of Tacoma, and Chas. Russell Collins, of Seattle. The plant will be built this summer, and the cost thereof is put at $60,000.

A CORRESPONDENT in Memphis, Tenn., forwards the following under date of June 20th: "At a very largely attended meeting of the City Council of Vicksburg, Miss., held recently, an ordinance granting a 50-year franchise to the Vicksburg Gas Company, the Company agreeing to charge not to exceed $1.50 per 1,000 cubic feet, the city reserving the right to revise the contract at the end of 10 years, was considered. The Mayor, as President of the Council, vetoed the ordinance and outlined his views fully. At the request of the Aldermen he convened a special meeting of the Board, when the ordinance was considered and passed over the veto by a two-thirds vote. This action seems in line with public sentiment, and the action of the majority was greeted with applause."

THE new plant of the Dixon (Ills.) Power and Lighting Company is to be constructed on a site purchased in West Dixon; at least so says General Manager Higgins.

THE Board of Directors of the New Haven (Conn.) Gas Light Company has notified the holders that the convertible debentures of the Company have been called in and will, on the 1st day of July, be converted into stock of the Company. The new stock will participate in dividends on and after September 30, 1903. Interest on the debentures at the rate of 4 per cent. will be paid at the office of the Company on July 1, 1903, on presentation of certificates with coupons attached. Debenture certificates may be surrendered at the office of the Company and exchanged for stock certificates on and after July 1. The Directors also made the important announcement that they do not expect, after the dividend to be paid the first of next month, to be able to maintain the present rate of dividend, which is 10 per cent. They do expect, however, to pay 8 per cent. This announcement may come as a surprise to many stockholders, but will not surprise financeers who have felt ever since the Company materially increased its ramifications, within a year that it would not be able to pay a 10 per cent dividend."

THE gas rate at Red Bluff, Cal., has been reduced to $2 per 1,000.

THE authorities of Baltimore, Md., have awarded a contract to the Consolidated Gas Company, under which the latter agrees, for a period of two years, to furnish gas for street lighting purposes at the rate of $7.25 per lamp per year.

THE properties of the Atlanta (Ga.) Gas Light Company and of the Georgia Railway and Electric Company, of Atlanta, have been merged.

GENERAL MANAGER FUERTADO, of the Baraboo (Wis.) Lighting Company, says that the new plant will be in operation by September 15th.

MR. O'FALLON JENKINS has been appointed City Gas Inspector for Kansas City vice Mr. William H. Clelland.

MR. GEORGE SMITH and associates announce that they will reconstruct the plant at Alpena, Mich. We understand that the Smith syndicate aims to secure complete ownership of the electric lighting and water supply plants of Alpena.

A CORRESPONDENT in Marquette (Mich.) writing under date of the 19th inst., incloses the following: "At a special meeting of the Hancock (Mich.) City Council, held yesterday, a franchise for the operation of a gas plant was granted to the Houghton County Gas Company. Like action was taken by the Red Jacket Council, at a meeting held two days ago. In both cases the franchises were given on the condition that each town be paid $200 yearly for the privileges accorded. The maximum price the Company is privileged to charge for its product was reduced 10 cents to $1.90 per 1,000 cubic feet, although it is understood the rate to be made will not be as high as this. Lake Linden previously had granted a franchise, and it now remains for only the Houghton and Laurium Councils to act on the matter."

THE plant at Rapid City, So. Dak., has been purchased by a syndicate of Grand Rapids (Mich.) capitalists, who propose to reconstruct the works. The officers of the reorganized concern are: President, E. M. Deane; Vice-President, Dwight Smith; Secretary, N. J. Heald; Treasurer, C. D. Kelsey.

THE Fayetteville (N. C.) Gas Light Company has been incorporated by Messrs. C. W. Broadfoot, H. C. Bock, H. W. Ray and W. H. Taylor. It is capitalized in $33,000.

THE new plant at Hanford, Cal., will be ready to operate by July 1st. So says Mr. Pedersen, of the Western Gas Construction Company.

THE proprietors of the Dedham and Hyde Park (Mass.) Gas and Electric Company have petitioned the Board of Gas and Electric Light Commissioners for permission to issue $40,000 of new stock, the proceeds of such issue to go towards extending the main system to the borough of Readville.

A CORRESPONDENT in Des Moines, Ia., forwards the following: "The Capital City Gas Company has planned a novel experiment in poultry raising. This morning (June 17th) 21 eggs, all of good pedigree, will be placed in an oven, heated by gas, and will be left there until they hatch. The oven will be kept at a temperature of 103, and a basin of water will be kept in the oven to prevent the air from becoming too dry. In the usual length of time it is expected the Company will have a fine brood of chickens."

THE AMERICAN GAS LIGHT JOURNAL

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St.
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegle, 30 Lime Street, London.

MONDAY, JUNE 29, 1903.

The Market for Gas Securities.

The features that have been most noticeable in the general share market—dullness, distrust and weakness—for the past month or more were again the leading features for the week just closed. The volume of business was smaller than in any prior week of the year, although money at fair rates was easily procurable, some good, round call loans having been negotiated at as low as 3½ per cent. The fact seems that the general public will have nothing to do with the Wall street game just now, and the further fact is that sellers for the short side are fearsome over going at their favorite game on account of the very low average prices prevailing. Consolidated closed to-day (Friday) at 191¾ to 192½. Some inquiry came to hand early in the week for Standard common, which inquiry, it is believed, had its origin in "inspired sources."

Brooklyn Union is lifeless as to transactions, and there is no change to chronicle in the routine bid and asked rates. Peoples, of Chicago, is steady, and it cannot be truthfully denied that strong interests, already identified with the Company's fortunes, have been taking it up at anything under 98. Lacledes are neglected and the same may be said of Baltimore Consolidated. Washington (D. C.) is returned at 320, ex rights. As has been the case for the past 6 months or more accredited issues of gas bonds are in good demand at advancing prices.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

16 WALL STREET, NEW YORK CITY.

JUNE 29.

☞All communications will receive particular attention.

☞The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$73,177,000	100	191¾	192½
Central Union, Bonds, 5's	3,000,000	1,000	109	111
Equitable Bonds, 6's	1,000,000	1,000	105	..
" 1st Con. 5's	2,300,000	1,000	118	120
Metropolitan Bonds	658,000	..	108	112
Mutual	3,500,000	100	290	315
Municipal Bonds	750,000	..	..	..
New Amsterdam Gas Co..				
Bonds, 5's	11,000,000	1,000	107½	108
Northern Union, Bonds, 5's.	1,250,000	1,000	106	107
New York and East River..				
Bonds 1st 5's	3,500,000	1,000	110	113
" 1st Con. 5's	1,500,000	.	109	111
Standard	5,000,000	100	131	..
Preferred	5,000,000	100	152½	..
Bonds, 1st Mortgage, 5's	1,500,000	1,000	115½	118
Yonkers	299,650	500	130	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	207	215
" " Bonds (5's)	15 000,000	1,000	119	119½
Bay State	50,000,000	50	⅛	¼
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	28	30
" 1st Mtg. 5's	509,000	1,000	93	96
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	7	10
" " Bonds, 5's	5,250,000	1,000	73	76
Capital, Sacramento	500,000	50	..	35
Bonds (6's)	150,000	1,000	..	..
Central, San Francisco	1,000,000	..	106	108
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	104¼
Cincinnati Gas & Elec. Co.	29,500,000	100	96½	97
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	101	101½
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	88¼	89¼
Preferred	3,026,500	100	107½	109
Consumers, Jersey City Bonds	600,000	1,000	100	102
Consumers, Toronto	1,700,000	50	218	225
Consolidated, Baltimore	11,000,000	100	67	67¼
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N.J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	85	87
Consolidated G. & E. Co.'s. Little Falls, N.Y.	90,000	100		100
Bonds	75,000	..	..	100
Detroit City Gas Co	4,825,500	50	..	89
" Prior Lien 5's	5,603,000	1,000	99½	100
Detroit Gas Co., 5's	382,000	1,000	77	79
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	245	265
Hudson County Gas Co., of New Jersey	10,500,000	..	25	..
" Bonds, 5's	10,500,000	..	101	103
Indianapolis	2,000,000	..	60	70
" Bonds, 6's	2,650,000	..	102½	105
Jackson Gas Co	250,000	50	73	75
" 1st Mtg. 5's	290,000	1,000	101	102½
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100	..	.
Preferred	2,500,000	100	92½	..
Bonds	10,000,000	1,000	109½	110
Lafayette Gas Co., Ind.	1,000,000	100		60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	130	140
Madison Gas & Elec. Co.				
" 1st Mtg. 6's	350,000	1,000	107½	108½
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	184¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co	6,000,000	..	56	58
Bonds, 6's	4,600,000	..	105	105¾
New Haven	1,000,000	25	300	325
Oakland, Cal.	2,000,000	..	46	47
" Bonds	750,000	..	..	.
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	96⅝	97¾
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	
Rochester Gas & Elec. Co..	2,150,000	50	88	..
Preferred	2,150,000	50	118	..
Consolidated 5's	2,000,000	..	87½	90
San Francisco, Cal.	10,000,000	100	51½	52
St. Joseph Gas Co.				
" 1st Mtg. 5's	751,000	1,000	95	96½
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	92	93
Syracuse, N. Y.	1,975,000	100	42	45
Bonds	2,047.000	1,000	98½	99½
Washington, D. C	2,600,000	20	315	325
First mortgage 6's	600,000	..	..	..
Western, Milwaukee.				
Bonds, 5's	4,000,000	..	109½	110
Wilmington, Del.	600,000	50	232	

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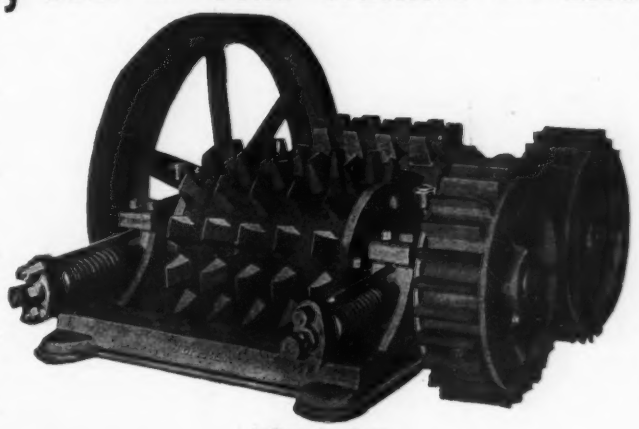

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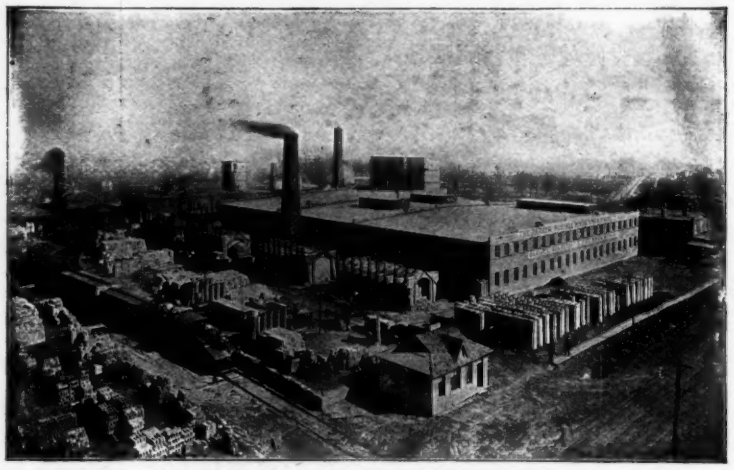

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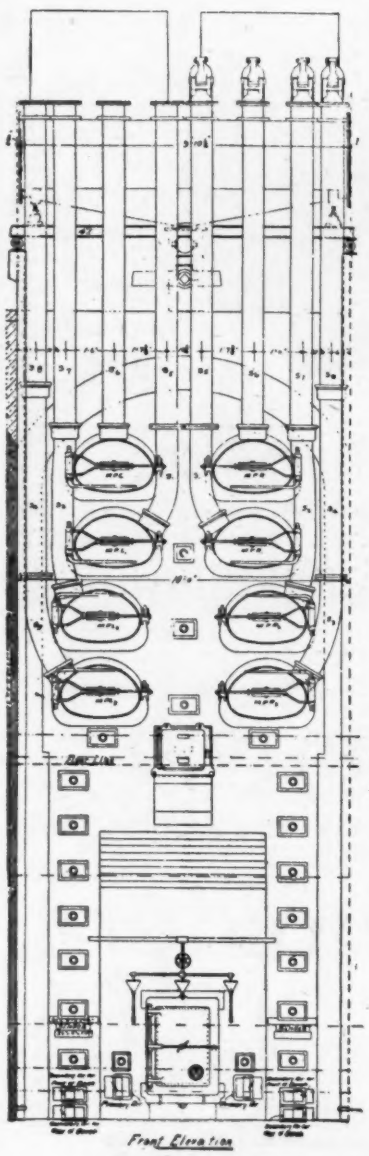

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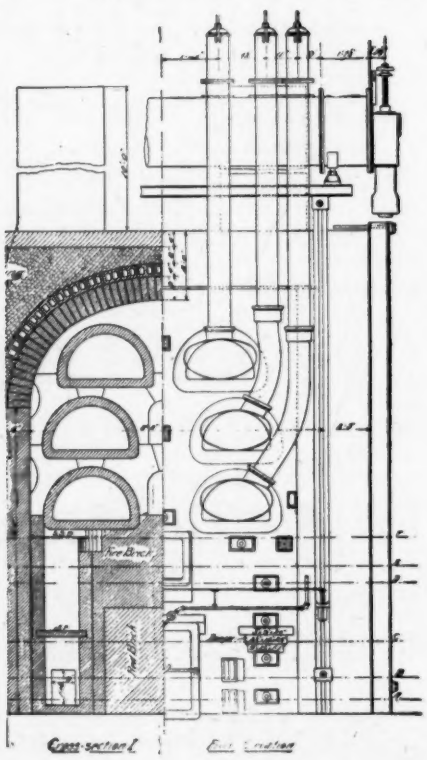

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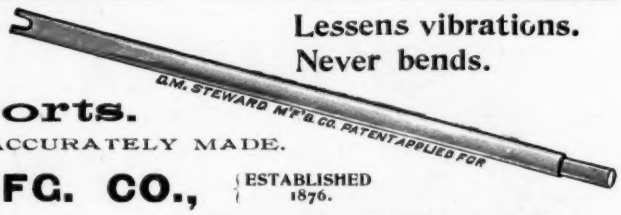

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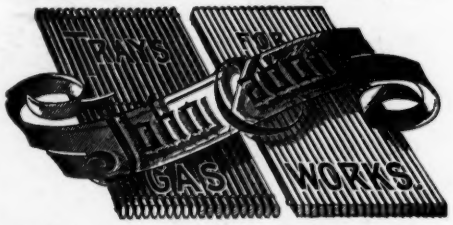

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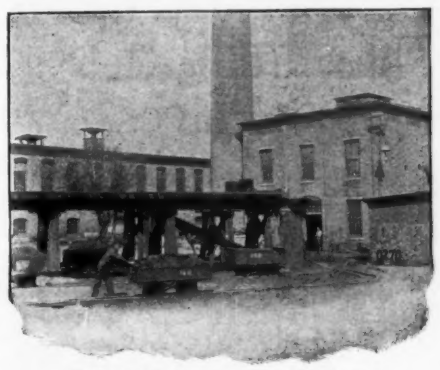

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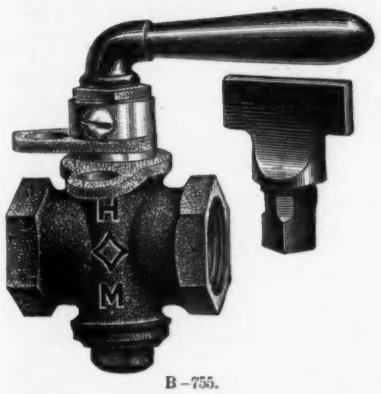

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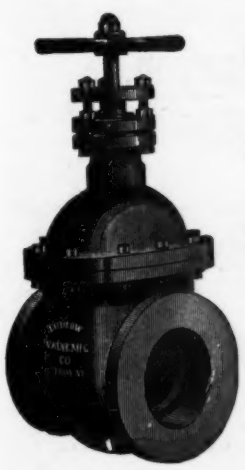

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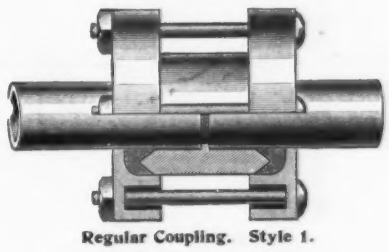
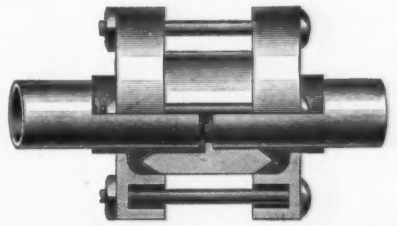
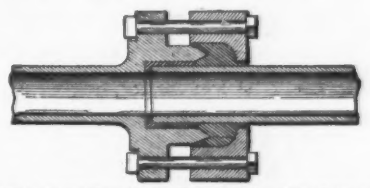


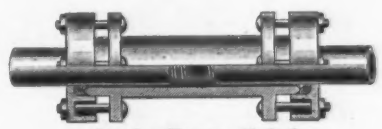
Regular Coupling. Style 1.



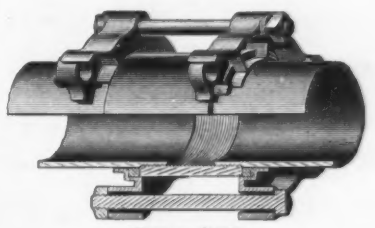
Insulating Coupling for Wrought Iron Pipe. Style 5.



Insulating Coupling for Bell and Spigot Cast Iron Pipe. Style 6.



Regular Sleeve. Style 2.



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My Insulating Coupling prevents the destruction of pipe by electrolytic action, in either water or gas lines.

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BY UTILIZING A

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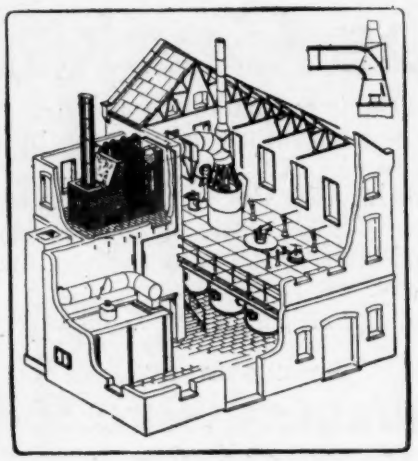

To absorb the heat now going to waste when you blow through your superheater to heat the feed water for your boilers to the temperature of the steam. This is now being done at the Poughkeepsie Gas Works, Poughkeepsie, N. Y. : : : : :

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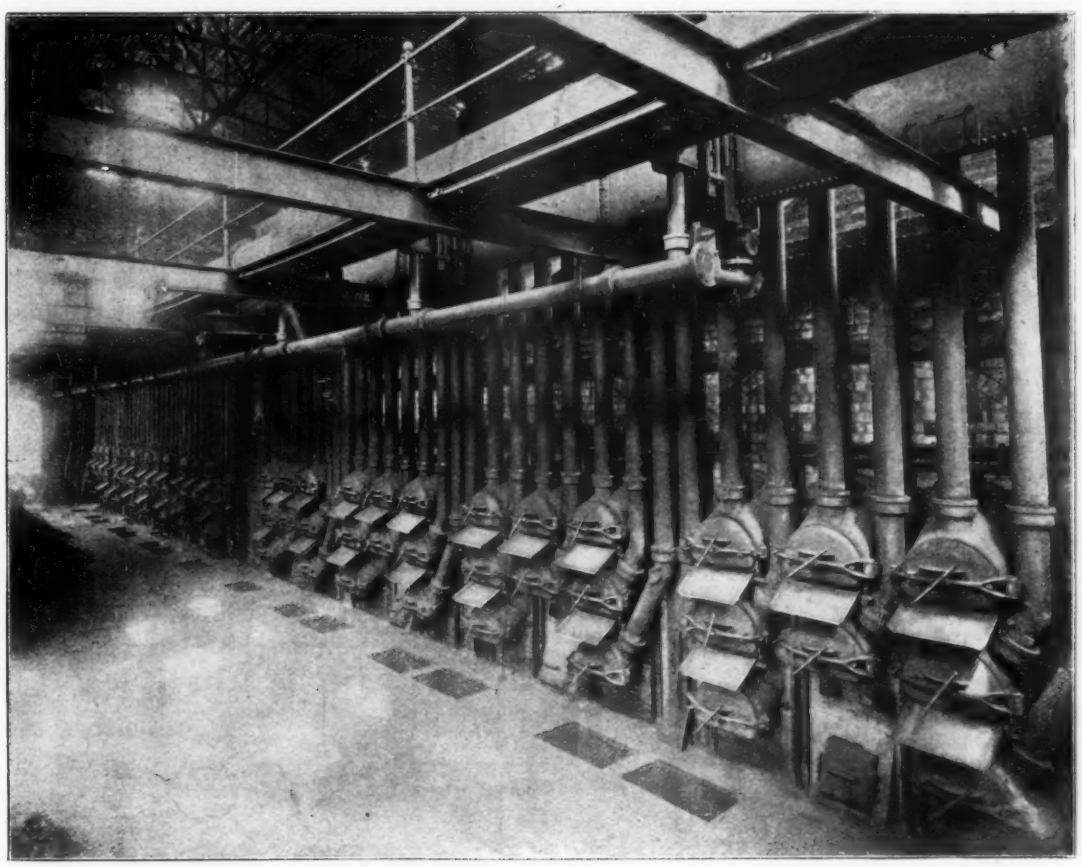

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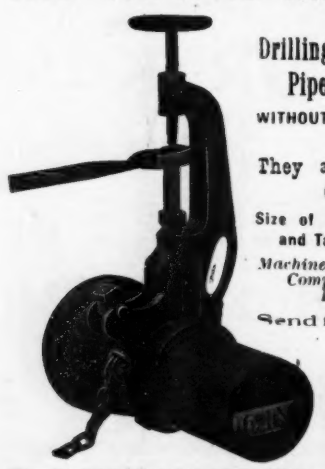
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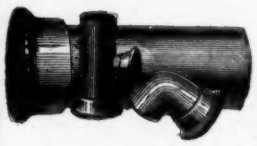
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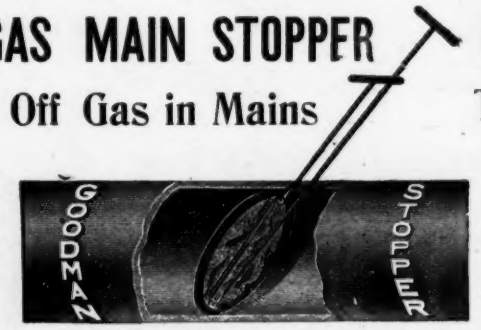

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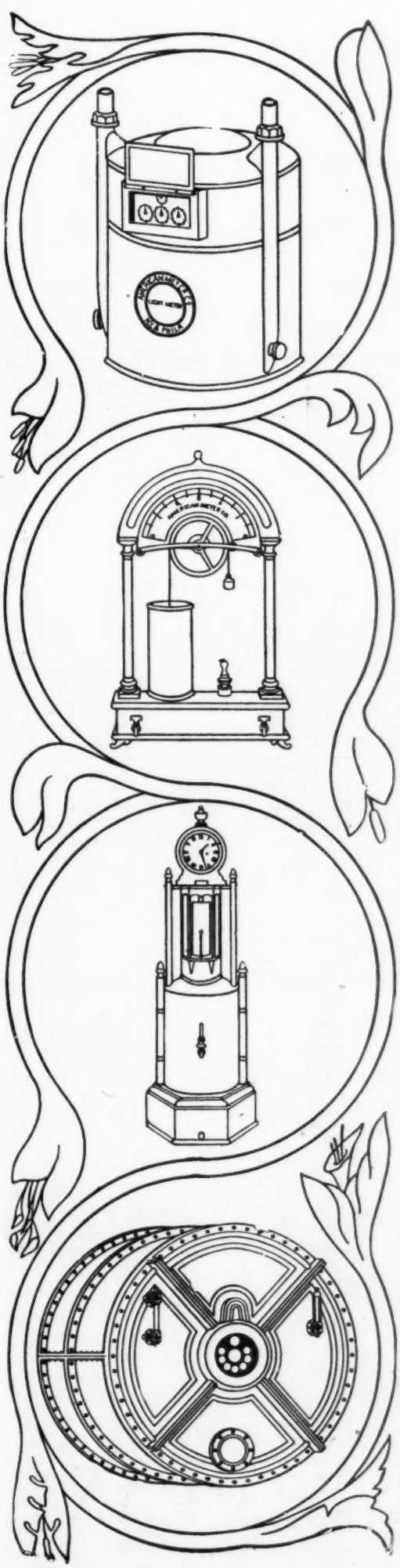
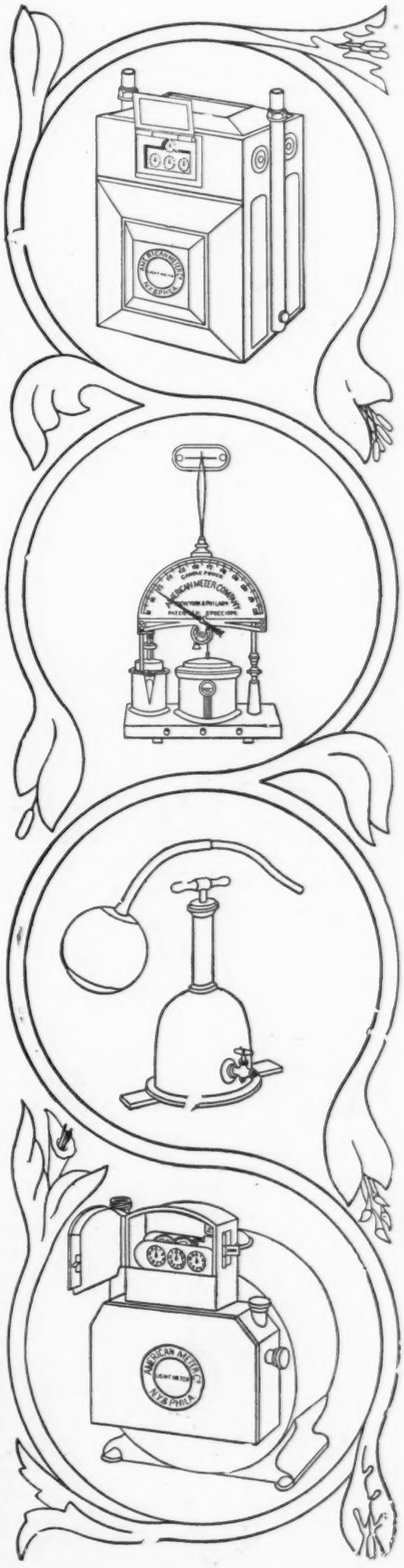




PUBLIC LIGHTING TABLE.

JULY, 1903.

Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Wed.	1	10.50 PM FQ	3.30 AM	7.30	3.15
Thu.	2	11.30	3.30	7.30	3.15
Fri.	3	12.00	3.30	7.30	3.15
Sat.	4	12.40 AM	3.30	7.30	3.15
Sun.	5	1.20	3.40	7.30	3.15
Mon.	6	2.10	3.40	7.30	3.15
Tue.	7	2.50	3.40	7.30	3.15
Wed.	8	No L.	No L.	7.30	3.15
Thu.	9	No L. FM	No L.	7.30	3.15
Fri.	10	No L.	No L.	7.30	3.15
Sat.	11	8.00 PM	9.30 PM	7.30	3.15
Sun.	12	8.00	10.00	7.30	3.15
Mon.	13	8.00	10.30	7.30	3.15
Tue.	14	8.00	11.00	7.30	3.15
Wed.	15	8.00	11.30	7.30	3.15
Thu.	16	8.00	12.00	7.20	3.15
Fri.	17	8.00 LQ	12.40 AM	7.20	3.15
Sat.	18	8.00	1.20	7.20	3.15
Sun.	19	7.50	2.00	7.20	3.15
Mon.	20	7.50	2.50	7.20	3.15
Tue.	21	7.50	3.50	7.20	3.15
Wed.	22	7.50	3.50	7.20	3.15
Thu.	23	7.50	3.50	7.20	3.15
Fri.	24	7.50 NM	3.50	7.20	3.15
Sat.	25	7.50	3.50	7.20	3.15
Sun.	26	7.50	3.50	7.20	3.15
Mon.	27	7.50	3.50	7.20	3.15
Tue.	28	7.50	3.50	7.20	3.15
Wed.	29	9.30	3.50	7.20	3.15
Thu.	30	10.00 FQ	3.50	7.10	3.30
Fri.	31	10.40	3.50	7.10	3.30

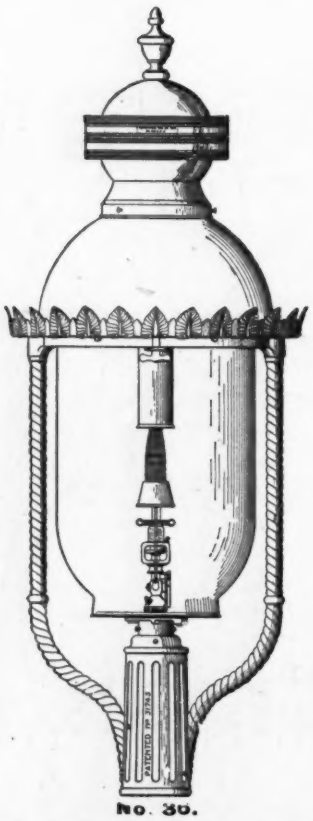
TOTAL HOURS LIGHTING DURING 1903.

By Table No. 1.	Hrs.Min.	By Table No. 2.	Hrs.Min.
January	245.00	January	423.20
February	192.00	February	355.25
March	201.00	March	355.35
April	167.20	April	298.50
May	152.00	May	264.50
June	131.00	June	234.25
July	140.40	July	243.45
August	156.20	August	280.25
September	171.20	September	321.15
October	198.20	October	374.30
November	216.30	November	401.40
December	232.10	December	433.45
Total, yr.	2203.40	Total, yr.	3987.45

NEW YORK, 33 Nassau Street. PHILADELPHIA, Broad and Arch Streets. CHICAGO, Foot of Orleans Street. BOSTON, 624 Tremont Building.
CLEVELAND, 809 Cuyahoga Building. ST. LOUIS, 712 Roe Building. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 30.

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Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

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By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

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IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

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No. 98.

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Here's what it would show if you give it a chance to prove its worth:

1. A mechanical construction and finish that insures the greatest durability.
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3. The greatest amount of candle power with least consumption of gas.
4. A by-pass cock so constructed as to permit all or only one mantle burning at a time.
5. A pilot light that consumes but 1 foot of gas in 24 hours. Costs $\frac{1}{10}$ of a cent a day.

Give it a Chance to Tell its Own Story and it Won't Disappoint.

Let us send you one lamp—doesn't cost a fortune—and it will answer every question you put to it; make good on every test given it. You know the only proof of the pudding? What's the use in a fellow telling you it tastes good? Taste it yourself, then you know.

May we Send you ONE Lamp?

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For the Six Months Ending July 1, 1903, has been Awarded Contracts in the Following Places for

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Baltimore, Md.	Hempstead, N. Y.	Dover, Del.
Chicago, Ills.	Chester, Pa.	Allentown, Pa.
Amesbury, Mass.	Lynn, Mass.	Savannah, Ga.
Aberdeen, S. D.	Newark, N. J.	New York (Central Union Co.)
Winsted, Conn.	Washington, D. C.	Cicero, Ills.
Canon City, Col.	Boone, Ia.	Chicago (Ogden Co.)
Schenectady, N. Y.	Pueblo, Col.	Easton, Pa.
Hagerstown, Md.	Charlotte, N. C.	Lawrence, Mass.
Malden, Mass.	Fall River, Mass.	Council Bluffs, Ia.
Bridgeport, Conn.	Duluth, Minn.	Chattanooga, Tenn.
Albert Lea, Minn.	New York (Mutual Co.)	

TOTAL SETS TO JULY 1, 1903, ... 51
TOTAL DAILY CAPACITY, ... 55,150,000 cubic feet.
TOTAL SETS TO DATE, ... 498
TOTAL DAILY CAPACITY, ... 354,830,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
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Successor to WILLIAM GARDNER & SON.

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(ESTABLISHED 1856.)

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RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

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BENCH SETTINGS,
Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

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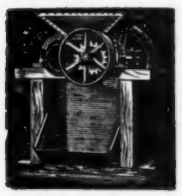

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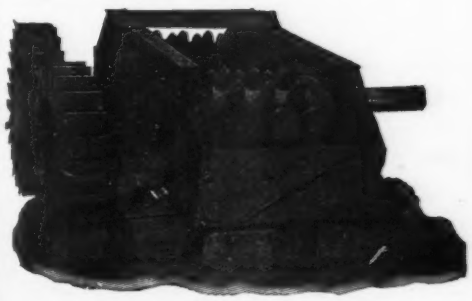

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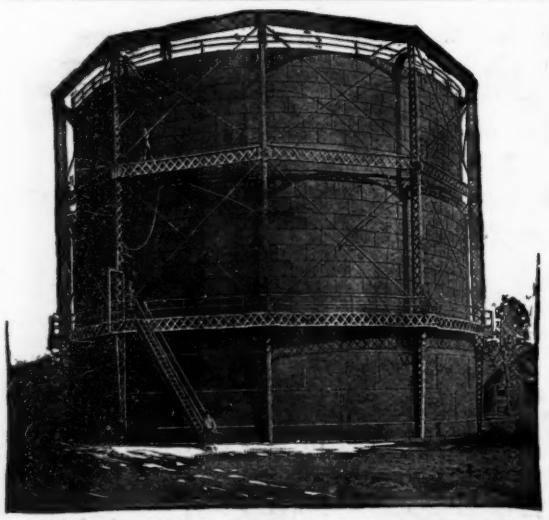

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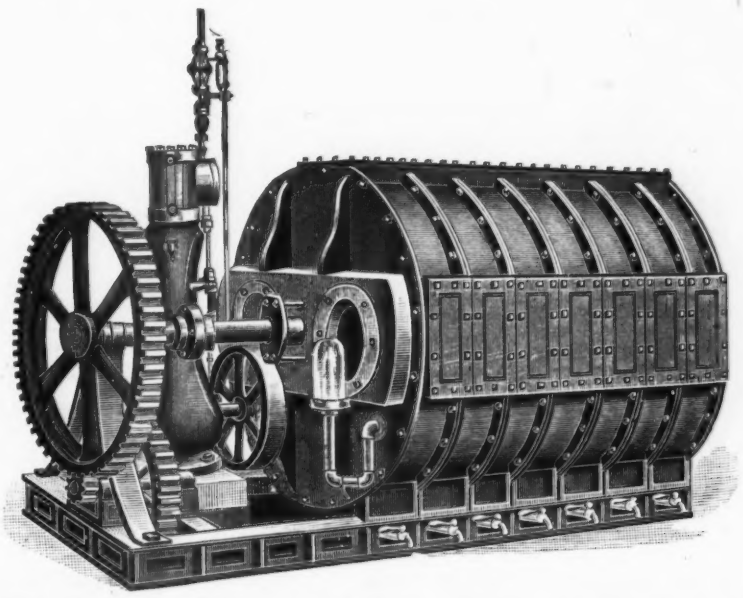

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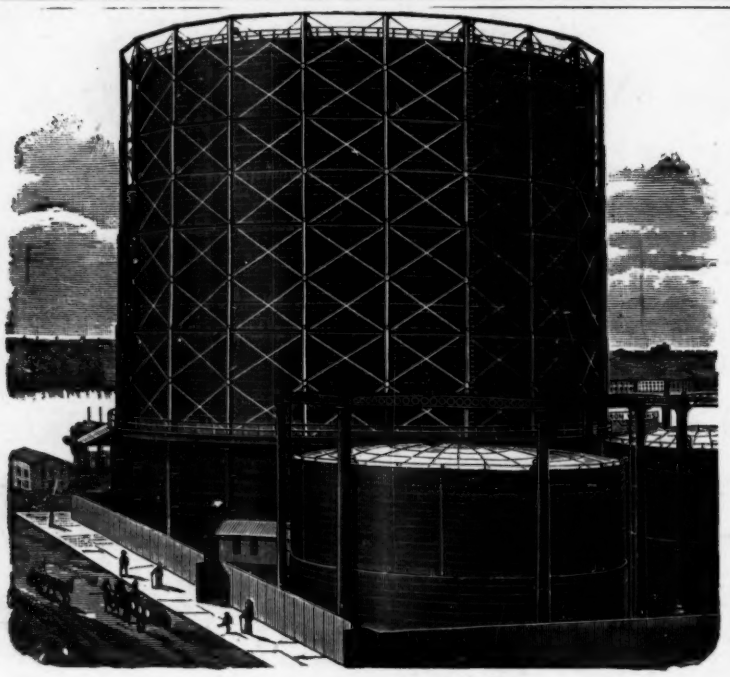

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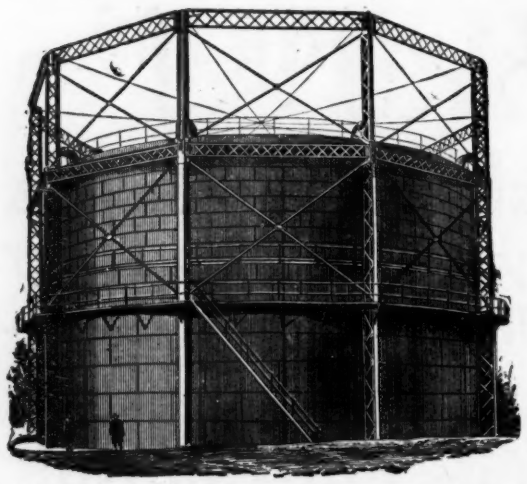

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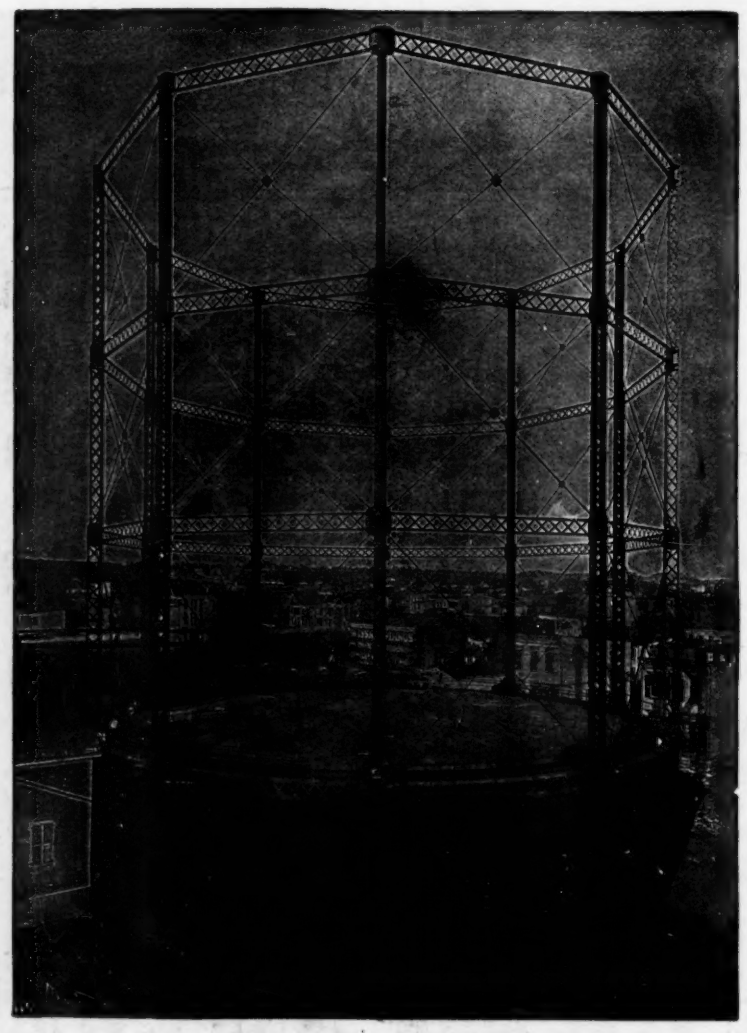

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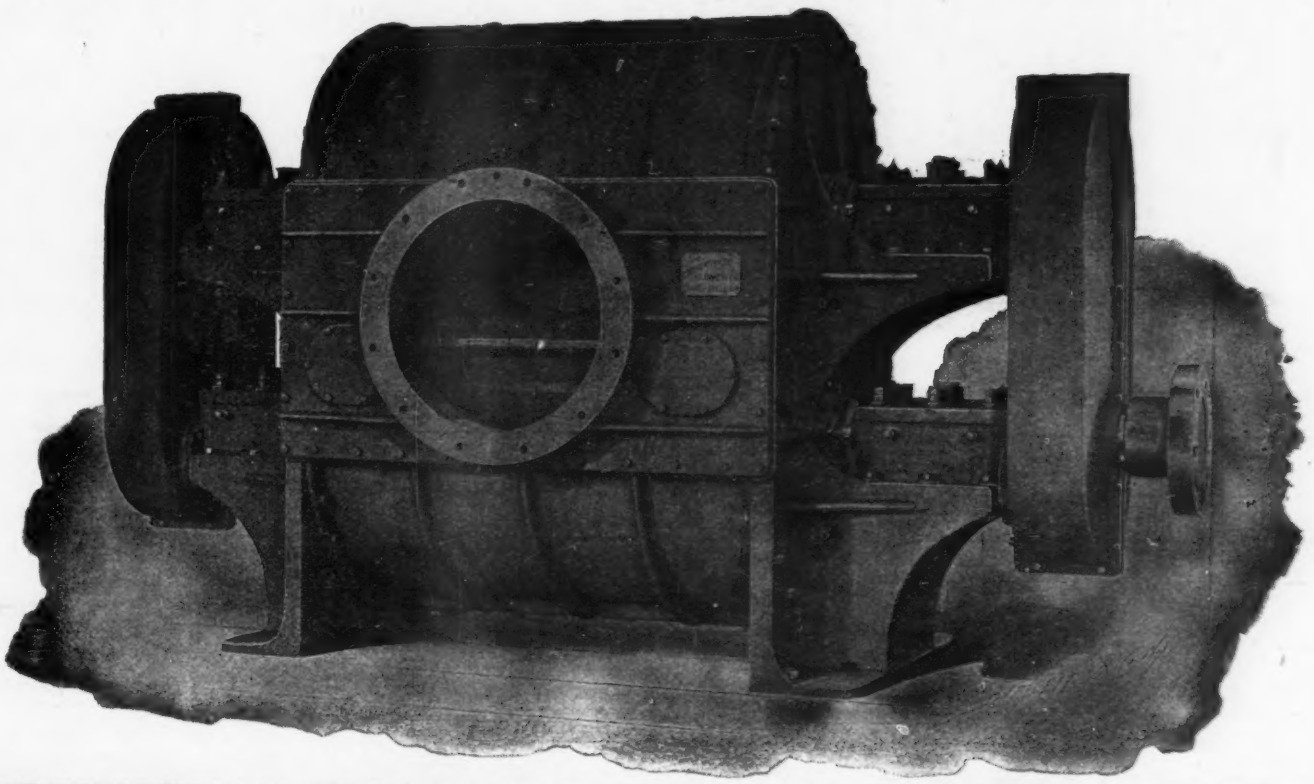

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